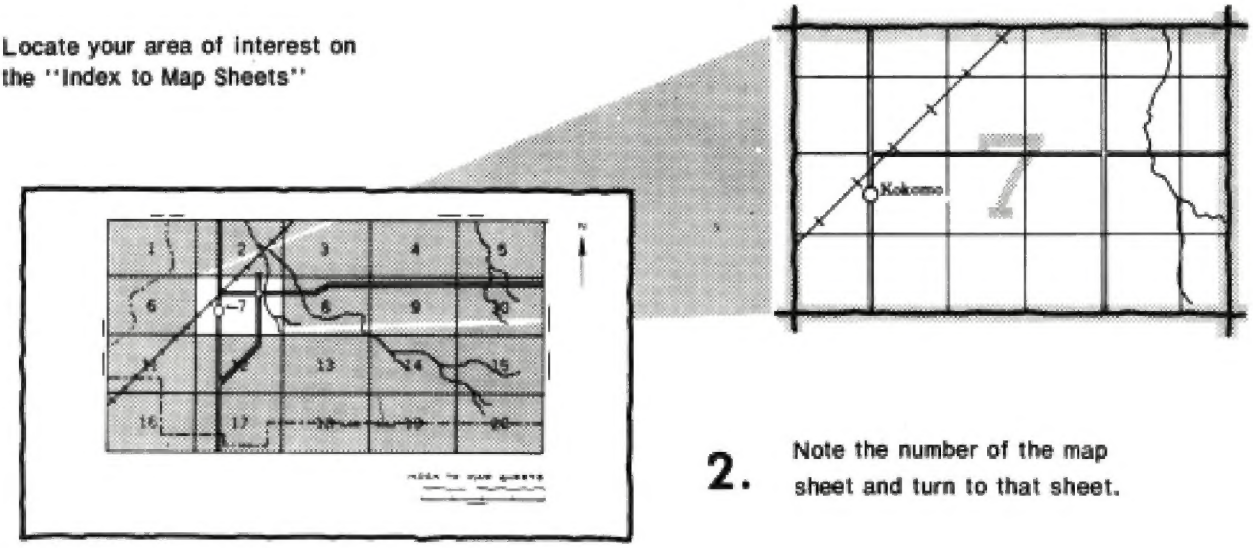
SOIL SURVEY OF

Campbell County, South Dakota

United States Department of Agriculture
Soil Conservation Service
in cooperation with
South Dakota Agricultural Experiment Station

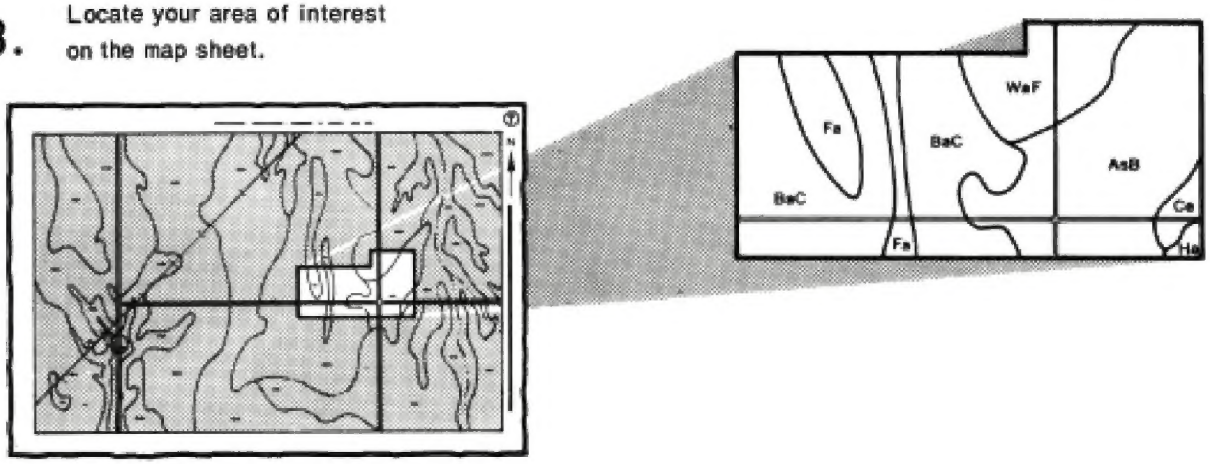
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets"

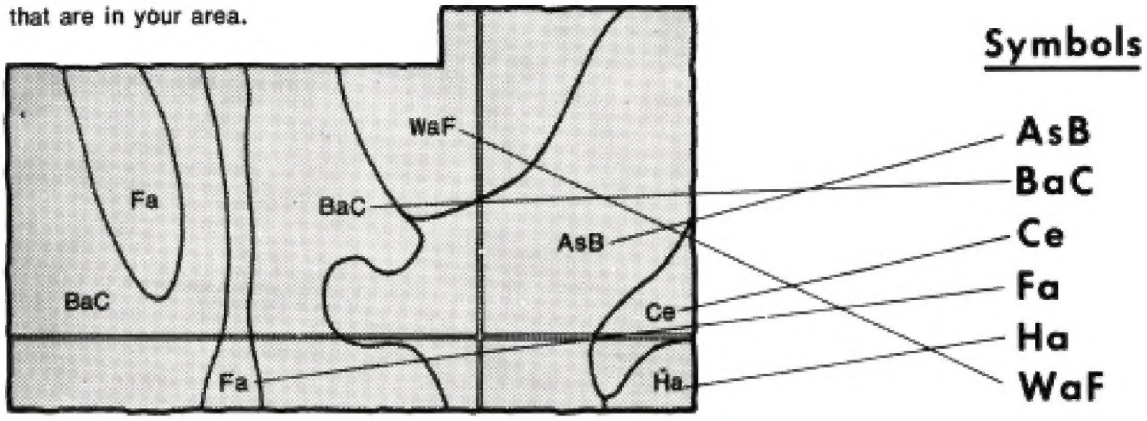


2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.

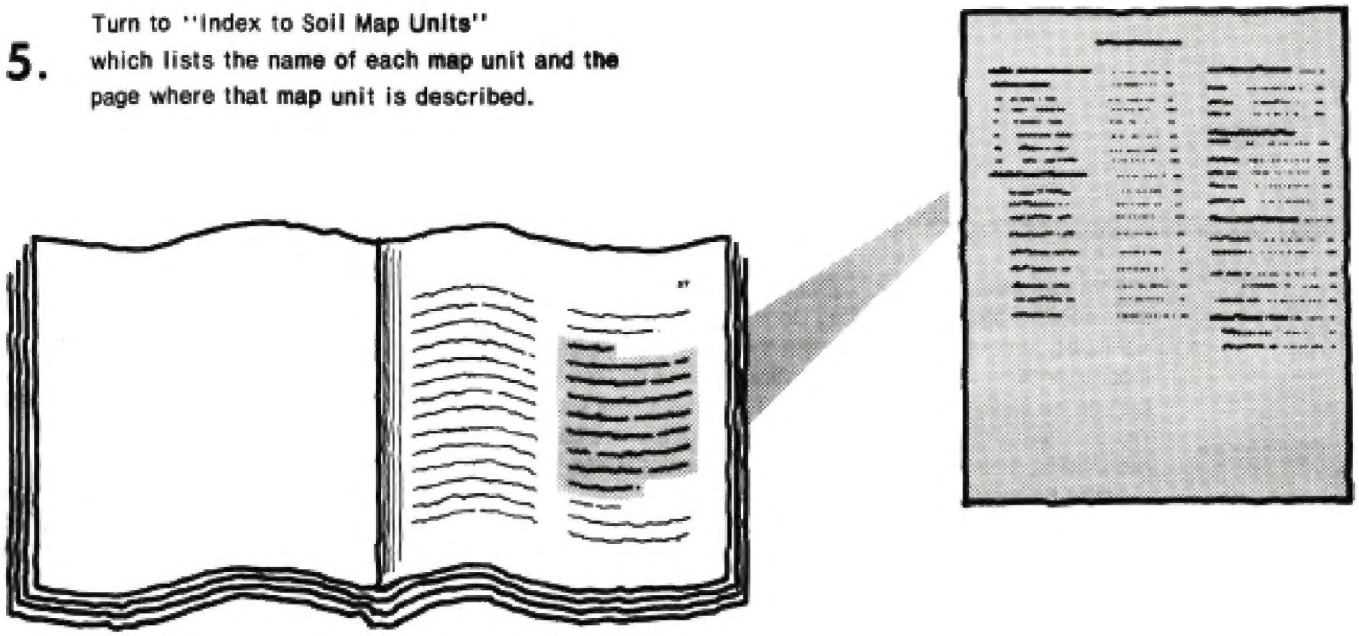


4. List the map unit symbols that are in your area.

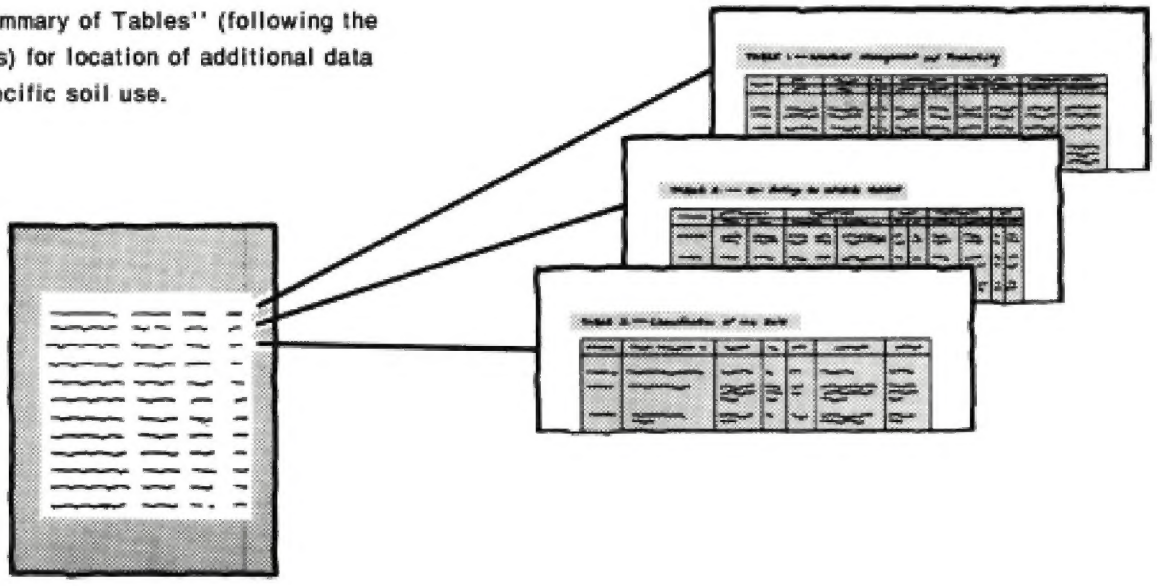


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1973-1977. Soil names and descriptions were approved in 1978. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1978. This survey was made cooperatively by the Soil Conservation Service and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the Campbell County Conservation District. Financial assistance was furnished by the South Dakota Department of Revenue and the Campbell County Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

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Issued October 1979

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Foreword

This soil survey contains much information useful in land-planning programs in Campbell County, South Dakota. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

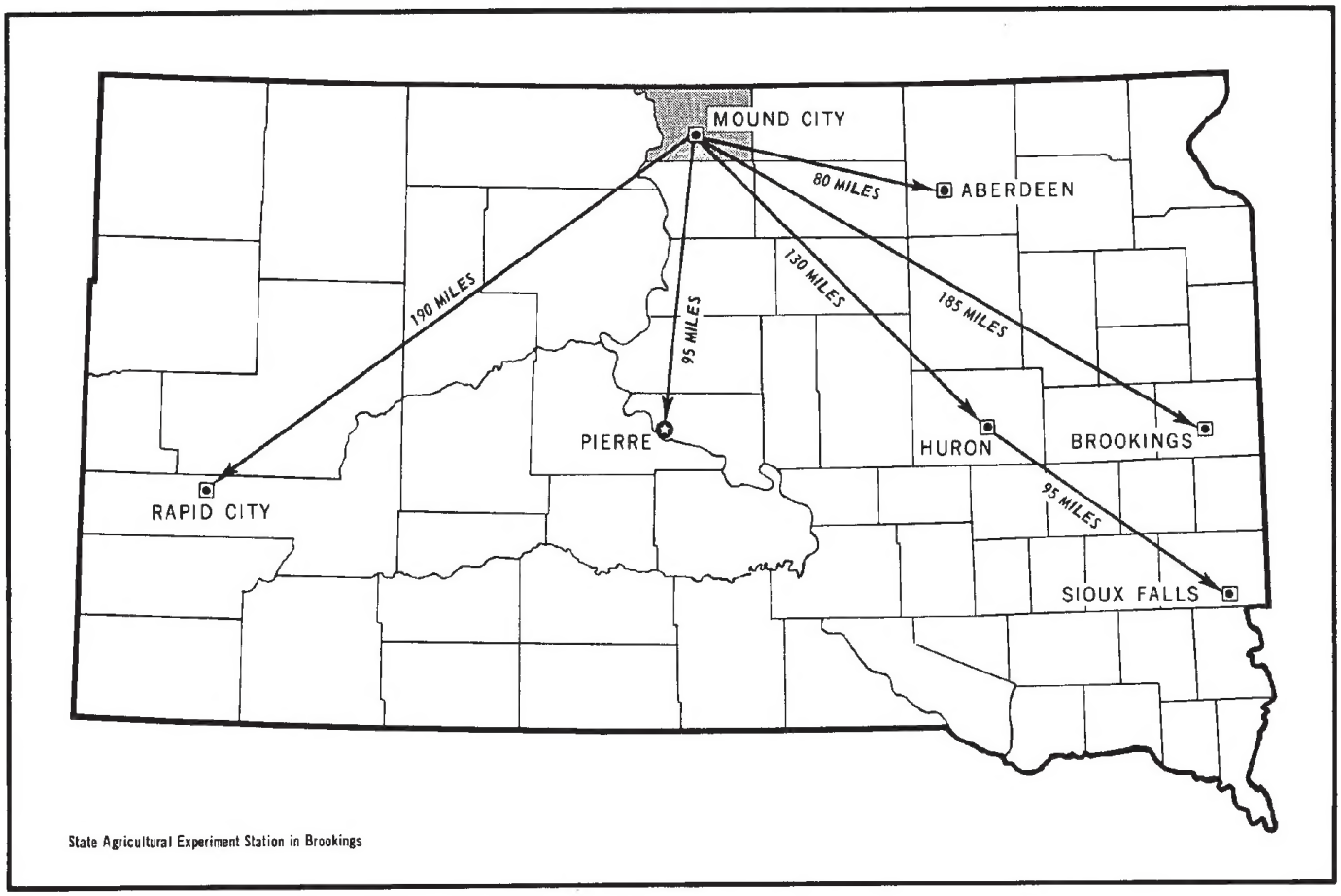
This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

R. D. Swenson
State Conservationist
Soil Conservation Service



Location of Campbell County in South Dakota.

soil survey of campbell county, south dakota

United States Department of Agriculture
Soil Conservation Service

in cooperation with
South Dakota Agricultural Experiment Station

By Thomas M. Schumacher and
Kenneth J. Heil, Soil Conservation Service

Soils surveyed by Thomas M. Schumacher
Kenneth J. Heil, Glen A Borchers
James A. Clausen, John Kalvels, and
Bruce O. Kunze
Soil Conservation Service

CAMPBELL COUNTY is in the north-central part of South Dakota. It has a total area of 492,800 acres, which includes about 24,064 acres of water. According to the 1970 census, it has a population of 2,866. The county seat, Mound City, in the center of the county, had a population of 164 in 1970, and Artas had one of 73, Pollock one of 341, and Herreid, the largest town, one of 672.

About 60 percent of the acreage is cropland, and about 35 percent supports native grass. Spring wheat, oats, corn, and alfalfa are the main crops. Farming is diversified; livestock is the main source of income, but income from cash crops is also important.

General nature of the county

This section gives general information concerning the county. It describes climate, physiography and relief, settlement, farming, and natural resources.

Climate

Campbell County is usually warm in summer, when it is subject to frequent spells of hot weather and occasional cool days. It is very cold in winter, when arctic air frequently surges over the area. Most precipitation falls during the warm period, and precipitation is normally heaviest in late spring and early summer. Winter snowfall normally is not too heavy, and it is blown into drifts so that much of the ground is free of snow.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Pollock for the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 14 degrees F, and the average daily minimum temperature is 2 degrees. The lowest temperature on record, which occurred at Pollock on January 21, 1954, is -40 degrees. In summer the average temperature is 70 degrees, and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred on July 11, 1973, is 109 degrees.

Growing degree days, shown in table 1, are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 13 inches, or 80 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 11 inches. The heaviest 1-day rainfall during the period of record was 3.23 inches at Pollock on June 28,1961. Thunderstorms occur on about 35 days each year, and most occur in summer. Hail falls in scattered small areas during some of these storms.

Average seasonal snowfall is 25 inches. The greatest snow depth at any one time during the period of record was 18 inches. On the average, 75 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year. Blizzards occur several times each winter.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The percentage of possible sunshine is 70 in summer and 50 in winter. The prevailing wind is from the west-northwest. Average windspeed is highest, 13 miles per hour, in April.

Climatic data in this section were specially prepared for the Soil Conservation Service by the National Climatic Center, Asheville, North Carolina.

Physiography and relief

Campbell County is mostly in the Coteau du Missouri division of the Missouri Plateau part of the Great Plains province (*3*). The western edge of the county is in the Missouri River Trench, which is in part occupied by Lake Oahe, an impoundment of the Missouri River. Relief is hilly to steep on the breaks adjacent to Lake Oahe. Most of the county is on a gently undulating to gently rolling glaciated plain. Gently rolling to hilly relief is on the sides of the valley cut by Spring Creek, where the creek flows westerly from the town of Artas to Lake Oahe. Gently rolling to steep glacial moraines cover the east-central part of the county. Land elevations range from 1,620 feet, which is the maximum flood level of Lake Oahe, to 2,080 feet, in the west-central part of the county.

Settlement

French fur traders probably visited what is now Campbell County before Lewis and Clark camped at the mouth of Spring Creek on their way up the Missouri River in 1805. The first settlement was established by Andrew Marsh in 1864, along the Missouri River a few miles north of the mouth of Spring Creek. This settlement was known as Vanderbilt.

Campbell County was established by an act of the 1873 Dakota Territory Legislature and was formally organized in 1884, at which time the settlement of LeGrace was selected as the first county seat. In 1888, the county seat was moved to Mound City.

A steady settlement of the county began in 1884, when the preemption, homestead, and timber cutline laws were passed. The extension of the railroad into the county in 1901 brought another large influx of settlers. The towns of Artas, Herreid, and Pollock were established along the railroad and soon became the main trading and shipping centers for the area.

The population of the county increased steadily until 1930, when it reached a high of 5,629. It began to decline during the drouth and depression years of the 1930's. It declined to 3,531 by 1960 and 2,866 by 1970. The major towns are Herreid, Pollock, Mound City, and Artas. The pioneer towns of LeGrace and Vanderbilt remain as only historic sites.

Farming

The first settlers in Campbell County were mainly rivermen and cattle ranchers. The rivermen, who settled in the river town of Vanderbilt, engaged in trapping and in supplying fuel wood to river steamers. The cattle ranchers made use of the abundant prairie grasses and were able to market their grass-fed cattle by drives to the mining districts in the Black Hills or to railroads to the east and south.

Homesteaders began to file claims in the 1880's. They confined their efforts mainly to the production of small grain and some livestock. When the railroad crossed the county in 1901, a new era began. Land values went up, crop production increased, and more land was brought under cultivation.

A succession of dry years in the 1930's caused considerable soil blowing in the county. Farmers and ranchers recognized the problems of water erosion, soil blowing, and overgrazing of grassland and thus the need for soil and water conservation. About 96 percent of the landowners voted in favor of establishing the Campbell County Conservation District, which was organized in 1947.

The present trend is toward fewer and larger farms. In 1974, Campbell County had a total of 410 farms, the average size of which was 1,100 acres (*5*). The main farm enterprises are grain farming, livestock raising, and dairying.

The steeper and stonier areas are best suited to grazing and livestock production, whereas the other areas commonly are well suited to general farming, including cash grain and cultivated crops, if erosion is controlled. The major crops are spring wheat, oats, corn, and alfalfa. Of the livestock raised, beef cattle are the largest in number, followed by hogs, sheep and lambs, and milk cows and heifers. The capabilities and potentials of the soils in Campbell County and the present economic conditions indicate that beef cattle and spring wheat will continue to be the basis of the economy in the county.

Natural resources

Soil is the most important natural resource in the county. It provides a growing medium for the crops produced on farms and the grass on rangeland.

In most of the county, water is adequate for domestic use and for watering of livestock. The quantity and quality of the water ranges from poor to good. Generally, the best sources are where there are thick deposits of outwash sand and gravel. In the northwest and south-central parts of the county, the aquifer produces water in quantities sufficient for irrigation. Surface water impoundments and deep wells are the main sources of water in those parts of the county where clay shale is near the surface. Lake Oahe is an important source of water for domestic use and irrigation.

Deposits of outwash sand and gravel, which are used for construction purposes, are the chief mineral resources in the county.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area know-

ing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land-use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, home buyers, and those seeking recreation.

General soil map for broad land-use planning

The general soil map at the back of this publication shows, in color, the soil associations in this survey area. Each association has a distinct pattern of soils and of relief and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one association differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The associations in this survey area have been grouped for broad interpretive purposes. The broad groups and the 11 soil associations are described on the pages that follow. The names of the associations do not coincide exactly with those on the general soil maps in the published surveys of Edmunds and Walworth Counties, South Dakota, mainly because of differences in the composition of the associations but also because of differences in detail of the general soil maps and changes in the application of the soil classification system.

Nearly level, sodium affected soils on flood plains

The only association in this group is on flood plains along drainageways. The relief dominantly is nearly level. The soils are silty and formed in loamy, silty, and clayey alluvium.

This association makes up about 5 percent of the county. About 85 percent of the acreage is rangeland. Much of the cropland is used for tame pasture and hay.

1. Harriet-Ranslo association

Deep, poorly drained and somewhat poorly drained, nearly level silty soils on flood plains

This association is on bottom land and terraces. Slopes are nearly level and smooth to slightly concave. The smooth relief is broken by channeled drainageways in most areas.

This association makes up about 5 percent of the county. It is about 30 percent Harriet soils, 25 percent Ranslo soils, and 45 percent minor soils.

The poorly drained Harriet soils are on the lower parts of the landscape. Slopes are 0 to 1 percent. Typically, the surface layer is gray silt loam. The subsoil is dark gray, firm clay. The lower part of the subsoil has nests of salts that extend into the underlying material. The underlying material is gray, light gray, and light brownish gray, calcareous silty clay.

The somewhat poorly drained Ranslo soils are on slight rises. Slopes are 0 to 2 percent. Typically, the surface layer is dark gray silt loam. The next layer is dark gray clay loam and gray silt loam. The upper part of the subsoil is dark gray, firm clay loam, and the lower part is grayish brown, firm, calcareous silty clay loam. The underlying material is olive gray, calcareous silty clay loam.

Minor in this association are the poorly drained Egas soils, which occur as areas intermingled with areas of the Harriet soils; the well drained Farnuf soils, which are on the higher parts of the landscape and on rises and are the most extensive of the minor soils; the well drained Grail soils, which occur as areas intermingled with areas of the Ranslo soils; and the well drained Straw soils, which are dissected by channeled drainageways.

The major soils are subject to occasional flooding. The claypan subsoil of these soils limits water intake, the depth to which plant roots can penetrate, and the amount of moisture that can be released to plants. These soils have a water table within 5 feet of the surface most of the year. Runoff is slow.

About 85 percent of this association is rangeland. Because of flooding and the claypan subsoil, the major soils are best suited to rangeland or tame pasture and hay.

The Harriet soils have fair potential for rangeland and poor potential for cultivated crops, tame pasture, and hay. The Ranslo soils have good potential for rangeland and fair potential for cultivated crops, tame pasture, and hay. Both soils have fair potential for rangeland wildlife habitat. They have poor potential for building sites and most sanitary facilities because of flooding and wetness.

Nearly level to very steep clayey and sandy soils underlain by bedrock

This group of associations is on uplands and river breaks adjacent to Lake Oahe and Spring Creek. The relief dominantly is moderately sloping to moderately steep. The soils are sandy and clayey and dominantly are shallow and moderately deep over sandstone and shale.

This group makes up about 11 percent of the county. About 90 percent of the acreage supports native grass. Nearly all of the soils are used for grazing.

2. Lihen-Flasher association

Deep and shallow, well drained and somewhat excessively drained, strongly sloping to very steep sandy soils on uplands

This association is mainly on hills, ridges, and breaks. Typically, it is dissected by prominent drainageways that flow into larger drainageways. Slopes dominantly are strongly sloping to moderately steep. Gently sloping to moderately sloping areas are on some foot slopes and on some of the broader ridgetops. In some of the steeper rimrock areas, hard siltstone and sandstone are exposed.

This association makes up less than 1 percent of the county. It is about 40 percent Lihen soils, 20 percent Flasher soils, and 40 percent minor soils.

The deep, well drained Lihen soils are on the mid and lower sides of ridges and on some of the broader ridgetops. Slopes range from 9 to 20 percent. Typically, the surface layer is brown loamy fine sand. Below this is a transitional layer of brown, calcareous loamy fine sand. The underlying material is brown and light olive brown, calcareous loamy fine sand and fine sandy loam.

The shallow, somewhat excessively drained Flasher soils are on the tops and upper sides of ridges and hills. Slopes range from 25 to 50 percent. Typically, the surface layer is dark grayish brown loamy fine sand. The underlying material is olive brown loamy fine sand over light yellowish brown fine sand. Soft sandstone is at a depth of 18 inches.

Minor in this association are the well drained silty Linton soils in gently sloping or moderately sloping areas on broad ridgetops; the well drained clayey Opal soils on the lower slopes; the well drained silty Sully soils on the upper sides and tops of ridges; and the well drained loamy Zahl soils on the sides of some drainageways.

About 95 percent of this association is rangeland. Raising beef cattle is the main farm enterprise. Slope is the main limitation and erosion the main hazard.

This association has poor potential for cultivated crops and tame pasture and hay. The Lihen soils have good potential and the Flasher soils fair potential for rangeland. Both soils have poor potential for building sites and sanitary facilities. Slope is the main limitation.

3. Opal-Sansarc-Promise association

Shallow to deep, well drained, nearly level to steep clayey soils on uplands

This association is mainly on ridges, hills, and breaks that extend back from Lake Oahe. Many small draws and prominent drainageways dissect the area. Slopes dominantly are moderately sloping to steep but are gently sloping to nearly level in some areas. The less sloping areas are on the lower parts of the landscape and on some of the broader ridgetops. Glacial stones

commonly are on the surface on the higher parts of the landscape.

This association makes up about 10 percent of the county. It is about 35 percent Opal soils, 25 percent Sansarc soils, 20 percent Promise soils, and 20 percent minor soils.

Opal soils are moderately deep over shale. They are on the mid and lower slopes and on some of the broader ridgetops. Slopes range from 3 to 25 percent. Typically, the surface layer is dark grayish brown clay. The subsoil is grayish brown and light brownish gray, very firm, calcareous clay. The underlying material is light brownish gray, calcareous clay and shaly clay. Gray shale is at a depth of about 31 inches.

Sansarc soils are shallow over shale. They are on the tops and upper sides of ridges and on the sides of drainageways. Slopes range from 6 to 40 percent. Typically, the surface layer is grayish brown, calcareous clay. The underlying material is grayish brown, calcareous shaly clay. Dark gray shale is at a depth of about 11 inches.

The deep Promise soils are on the foot slopes and fans along drainageways. Slopes range from 0 to 9 percent. Typically, the surface layer is dark gray clay. The subsoil is firm clay. It is dark gray in the upper part and olive gray and calcareous in the lower part. The underlying material is olive gray, calcareous clay.

The most extensive of the minor soils in this association are the moderately well drained Hurley soils, which have a claypan subsoil. These soils generally are on fans along drainageways. Other minor soils are the silty Linton soils on some of the broader ridgetops and terraces and the silty Sully and loamy Zahl soils on the tops of ridges and hills.

About 90 percent of this association is rangeland. Raising beef cattle is the main farm enterprise. Overgrazing is the main concern of management because it can quickly result in erosion and gullying. Small grain is grown in some areas. Nearly all of the cultivated acreage is areas of the nearly level to moderately sloping Opal and Promise soils. Slope is the main limitation and erosion the main hazard in these areas.

In most areas, the major soils have fair to poor potential for cultivated crops and tame pasture and hay. They have good to fair potential for rangeland. In most areas, they have good potential for rangeland wildlife habitat. Stock dams are the main source of water for livestock. These soils have poor potential for building sites and most sanitary facilities because of a high shrink-swell potential, steep slopes, a shallow or moderate depth to bedrock, and restricted permeability.

Nearly level to strongly sloping loamy and silty soils on uplands and terraces and in upland swales

This group of associations is on uplands. The relief dominantly is nearly level and gently sloping but is moderately sloping or strongly sloping near drainageways. The soils formed in loess, silty glacial drift, and alluvium.

This group makes up about 26 percent of the county. About 75 percent of the acreage is cropped. Alfalfa, corn, and small grain are the main crops. Some areas are irrigated.

4. Farnuf-Grail association

Deep, well drained, nearly level and gently sloping loamy and silty soils on terraces

This association is on high terraces that have some swales and closed depressions. Slopes generally are nearly level and gently sloping but are steeper on the sides of entrenched drainageways. The drainage pattern is poorly defined in most areas where drainageways terminate in small depressions, but it is well defined in areas along the larger drainageways.

This association makes up about 3 percent of the county. It is about 35 percent Farnuf soils, 15 percent Grail soils, and 50 percent minor soils.

Farnuf soils are on the sides and tops of rises and on the sides of some drainageways. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is friable clay loam. It is dark brown in the upper part and brown in the lower part. The lower part is calcareous. The underlying material is light brownish gray and grayish brown, calcareous loam. It has lenses of fine sandy loam in the lower part.

Grail soils are on broad flats, slightly concave swales, and the lower parts of low rises. Slopes range from 0 to 3 percent. Typically, the surface layer is dark gray silty clay loam. The subsoil is dark gray and grayish brown silty clay loam and silty clay. The underlying material is grayish brown, calcareous silty clay loam.

Minor in this association are the moderately well drained Bowbells soils in swales; the well drained clayey Promise soils, which occur as areas intermingled with some areas of the Grail soils; the well drained silty Savage soils, which occur as areas intermingled with some areas of the Farnuf soils; the well drained Straw soils along entrenched drainageways; and the poorly drained Tonka soils in closed depressions.

About 85 percent of this association is used for cultivated crops and tame pasture and hay. Corn, small grain, and alfalfa are the main crops. A few areas are irrigated. Some of the steeper areas, bordering the larger drainageways, are rangeland and are used for grazing or

hay. Conserving moisture, maintaining fertility, and controlling erosion in the more sloping areas are the main concerns of management if these soils are cropped.

This association has good potential for cultivated crops, tame pasture and hay, rangeland, and openland wildlife habitat. The Farnuf soils have good potential for most sanitary facilities and fair potential for most building sites. The Grail soils have only fair potential for most sanitary facilities and poor potential for most building sites because of restricted permeability and shrinking and swelling.

5. Bryant-Grassna association

Deep, well drained and moderately well drained, nearly level to moderately sloping silty soils on uplands and in upland swales

This association is on gentle rises and broad flats and in swales and closed depressions (fig. 1). Slopes are long and smooth. They generally are nearly level to undulating but are steeper on the sides of drainageways. The drainage pattern is well defined along the larger drainageways but is poorly defined in some areas where small drainageways terminate in depressions.

This association makes up about 14 percent of the county. It is about 40 percent Bryant soils, 15 percent Grassna soils, and 45 percent minor soils.

The well drained Bryant soils mainly are on the upper parts of the landscape. Slopes range from 0 to 9 percent. Typically, the surface layer is dark grayish brown silt loam. The subsoil is friable silt loam. It is brown in the upper part and light olive brown in the lower part. The underlying material is light brownish gray, calcareous silt loam.

The moderately well drained Grassna soils are in slightly concave swales. Slopes are 0 to 3 percent. Typically, the surface layer is very dark gray silt loam. The subsoil is friable silt loam. It is dark brown in the upper part and grayish brown in the lower part. The underlying material is light brownish gray and light yellowish brown, calcareous silt loam.

Minor in this association are the moderately well drained loamy Bowbells soils; the well drained Sutley soils, which are on the upper parts of the landscape and have lime at or near the surface; the poorly drained Tonka soils in closed depressions; and the well drained loamy Vida and Zahl soils on ridges and on the sides of

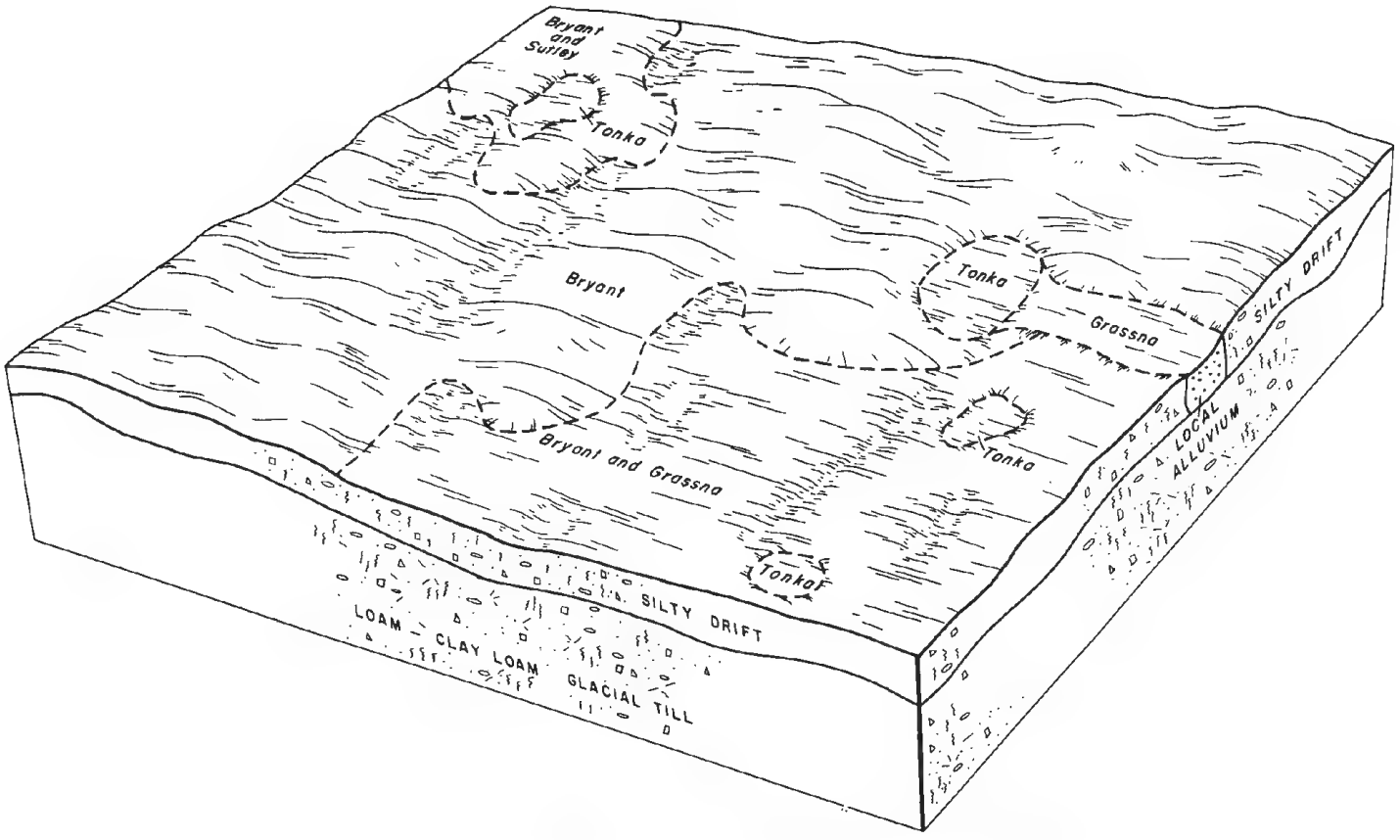


Figure 1.—Pattern of soils and topography in the Bryant-Grassna association.

entrenched drainageways. The Sutley soils are the most extensive minor soils.

About 70 percent of this association is used for cultivated crops and tame pasture or hay. Some areas are irrigated. Corn, alfalfa, and small grain are the main crops. Some of the steeper areas of Bryant soils support native grass and are used for grazing or hay. The main concerns in managing cropland are conserving moisture, maintaining fertility, and controlling erosion.

This association has good potential for most cultivated crops, tame pasture and hay, rangeland, and openland wildlife habitat. The Bryant soils have fair potential and the Grassna soils poor potential for most building sites and sanitary facilities. The Bryant soils are better building sites because the Grassna soils are subject to flooding.

6. Linton-Grassna association

Deep, well drained and moderately well drained, nearly level to strongly sloping silty soils on terraces and uplands and in upland swales

This association is mainly on broad flats and slight rises and in swales. Slopes are long and convex on the rises and concave in the swales. They generally are nearly level and gently sloping, but they are steeper along the larger, well defined drainageways. Drainageways are poorly defined in some areas, and in other areas they terminate in many small closed depressions.

This association makes up about 9 percent of the county. It is about 50 percent Linton soils, 15 percent Grassna soils, and 35 percent minor soils.

Linton soils are well drained and are on the convex parts of the landscape. Slopes range from 0 to 15 percent. Typically, the surface layer is dark grayish brown silt loam. The subsoil is friable silt loam. It is brown in the upper part, grayish brown in the middle part, and light brownish gray in the lower part. The underlying material is light brownish gray, calcareous silt loam.

Grassna soils are moderately well drained and are on the lower parts of low rises and in swales. Slopes are 0 to 3 percent. Typically, the surface layer is very dark gray silt loam. The subsoil is friable silt loam. It is dark brown in the upper part and grayish brown in the lower part. The underlying material is light brownish gray and light yellowish brown, calcareous silt loam.

Minor in this association are the well drained Sully soils, which have a light colored surface layer and are on the tops of some ridges; the well drained Sutley soils, which are on the upper parts of the landscape and have lime at or near the surface; the poorly drained Tonka soils in closed depressions; and the loamy Vida and Williams soils, which contain more clay than the major soils and are on slight rises. The Sutley soils are the most extensive minor soils.

About 80 percent of this association is used for cultivated crops and tame pasture or hay. Some areas are irrigated. Corn, small grain, and alfalfa are the main crops. Some of the steeper areas of Linton soils support native grass and are used for grazing or hay. The main concerns in managing cropland are conserving moisture, maintaining fertility, and controlling erosion and soil blowing.

This association has good potential for most cultivated crops, for tame pasture, hay, and rangeland, and for openland wildlife habitat. The Linton soils have good potential and the Grassna soils poor potential for most building sites and sanitary facilities. The Linton soils are better building sites because flooding is a hazard on the Grassna soils.

Nearly level to strongly sloping loamy and sandy soils on terraces and uplands

This group of associations is on terraces and uplands. The relief dominantly is nearly level and gently sloping but is steeper on some ridges and terrace fronts. The soils are sandy and loamy and dominantly are deep and moderately deep over sand or gravelly material.

This group makes up about 18 percent of the county. About 60 percent of the acreage is cropped. Alfalfa, corn, and small grain are the main crops. Some areas are irrigated.

7. Lehr-Bowdle association

Deep, somewhat excessively drained and well drained, nearly level to strongly sloping loamy soils on terraces

This association is on a glacial outwash terrace that has some drainageways and swales. Slopes are short and convex. They dominantly are nearly level and gently sloping but are steeper on the sides of some entrenched drainageways.

This association makes up about 6 percent of the county. It is about 35 percent Lehr soils, 20 percent Bowdle soils, and 45 percent minor soils.

The somewhat excessively drained Lehr soils mainly are on the upper and mid slopes. Slopes range from 0 to 15 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is very friable loam. It is dark grayish brown in the upper part and grayish brown and calcareous in the lower part. The underlying material is multicolored, calcareous sand and gravel.

The well drained Bowdle soils mainly are on the lower parts of the landscape. Slopes generally are slightly concave and range from 0 to 6 percent. Typically, the surface layer is very dark grayish brown loam. The subsoil is very dark grayish brown and dark grayish brown, friable loam. The underlying material is grayish brown, calcareous loam. Multicolored sand and gravel is at a depth of 25 inches.

Minor in this association are the moderately well drained Bowbells soils in swales; the well drained Tally and Williams soils, which are not underlain by sand and gravel; the poorly drained Tonka soils in closed depres-

sions; and the excessively drained Wabek soils on hills and ridges and along drainageways. The Wabek soils are the most extensive of the minor soils.

About 60 percent of this association is used for cultivated crops and tame pasture or hay. Some areas are irrigated. Corn, alfalfa, and small grain are the main crops. Some of the steeper soils support native grass and are used for grazing or hay. The main concerns in managing cropland are conserving moisture and controlling erosion in the steeper areas.

This association has fair potential for most cultivated crops and openland wildlife habitat. The Lehr soils have fair potential and the Bowdle soils good potential for rangeland and tame pasture and hay. This association has good potential for most building sites and poor potential for most sanitary facilities.

8. Tally-Maddock association

Deep, well drained, nearly level to strongly sloping loamy and sandy soils on uplands

This association is mainly on a glacial outwash plain on which gentle rises are above broad flats, swales, and some depressions. The drainage pattern is poorly defined, and small drainageways terminate in depressions. Slopes are long and smooth. They dominantly are nearly level to moderately sloping but are strongly sloping in some areas.

This association makes up about 9 percent of the county. It is about 40 percent Tally soils, 15 percent Maddock soils, and 45 percent minor soils.

Tally soils are on the mid and upper sides of low rises and knolls. Slopes range from 0 to 9 percent. Typically, the surface layer is dark grayish brown fine sandy loam. The subsoil is brown, very friable fine sandy loam. The underlying material is grayish brown and calcareous. It is fine sandy loam in the upper part and loamy fine sand in the lower part.

Maddock soils are in positions similar to those of Tally soils. Slopes range from 0 to 12 percent. Typically, the surface layer is very dark gray loamy fine sand. The subsoil is dark grayish brown, loose fine sand. The underlying material is brown fine sand in the upper part and grayish brown loamy fine sand in the lower part.

Minor in this association are Bowbells, Bowdle, Lehr, Parshall, Tonka, Williams, and Yecross soils. The moderately well drained Bowbells and well drained Williams soils are the most extensive of the minor soils. They contain more clay in the subsoil than Tally and Maddock soils and occur as areas scattered throughout the association. The well drained Bowdle and excessively drained Lehr soils are underlain by sand and gravel. They are nearly level or gently sloping. The well drained Parshall soils have a thick, dark colored surface layer. They are on the lower parts of the landscape and in swales. The poorly drained Tonka soils are in closed depressions. The excessively drained Yecross soils occur as areas intermingled with areas of the Maddock soils.

About 60 percent of this association is used for cultivated crops and tame pasture and hay. Some areas are irrigated. Small grain and alfalfa are the main dryland crops. Corn and alfalfa are the main irrigated crops. Some of the steeper areas support native grass and are used for grazing or hay. The main concerns of management are conserving moisture, maintaining fertility, and controlling soil blowing.

In most areas, this association has good potential for cultivated crops, tame pasture and hay, rangeland, and most building sites. It has fair potential for openland wildlife habitat and poor potential for most sanitary facilities.

9. Yecross-Maddock association

Deep, excessively drained and well drained, nearly level to strongly sloping sandy soils on uplands

This association is on slight rises above broad flats interrupted by swales. Slopes are long and smooth. They dominantly are nearly level or gently undulating but are steeper in some areas.

This association makes up about 3 percent of the county. It is about 40 percent Yecross soils, 15 percent Maddock soils, and 45 percent minor soils.

The excessively drained Yecross soils mainly are on gentle rises and broad flats. Slopes range from 0 to 15 percent. Typically, the surface layer is dark gray loamy sand. The underlying material is brown, calcareous sand in the upper part and grayish brown gravelly sand in the lower part.

The well drained Maddock soils are in positions similar to those of Yecross soils. Slopes range from 0 to 12 percent. Typically, the surface layer is very dark gray loamy fine sand and the subsoil is dark grayish brown, loose fine sand. The underlying material is brown fine sand in the upper part and grayish brown loamy fine sand in the lower part.

Minor in this association are the moderately well drained Hecla and well drained Parshall soils on the lower parts of the landscape and in swales; the excessively drained Seroco soils, which have a thin surface layer and are very gently sloping to moderately steep; and the well drained Tally and somewhat poorly drained Wyndmere soils, both of which contain more clay than Yecross and Maddock soils and are the most extensive minor soils. The Tally soils occur as areas scattered throughout the association, and the Wyndmere soils are on the lower parts of the landscape and in swales. The Seroco soils are near Dune land, which supports no vegetation.

About 50 percent of this association is used for cultivated crops and tame pasture or hay. Small grain and alfalfa are the main crops. Most of the steeper areas support native grass and are used for grazing or hay.

The main concerns of management are conserving moisture, maintaining fertility, and controlling erosion and soil blowing. Because of the soil blowing and a low available water capacity, this association is better suited to rangeland or tame pasture and hay than to cultivated crops.

This association generally has good potential for rangeland, building sites, and tame pasture and hay. It has fair potential for cultivated crops and rangeland wildlife habitat. It has poor potential for most sanitary facilities because of seepage and the possible pollution of shallow ground water.

Nearly level to moderately steep loamy soils on uplands and in upland swales

This group of associations is on uplands. The relief dominantly is nearly level to strongly sloping. The soils are loamy and formed in loamy glacial till.

This group makes up about 40 percent of the county. About 50 percent of the acreage is cropped. Much of the cropland is in the nearly level and gently sloping areas. Corn, small grain, and alfalfa are the main crops. Feed and forage crops also are grown.

10. Vida-Williams association

Deep, well drained, nearly level to moderately steep loamy soils on uplands

This association occurs mainly as gently sloping areas and as moderately sloping or strongly sloping areas on hills and ridges (fig. 2). Slopes dominantly are gently sloping to strongly sloping but range from nearly level to moderately steep. The drainage pattern generally is poorly defined in areas where drainageways terminate in closed depressions, but it is well defined in some areas along the larger drainageways. Scattered stones are on the surface and in the soils throughout the association and are numerous on some of the ridges.

This association makes up about 18 percent of the county. It is about 30 percent Vida soils, 25 percent Williams soils, and 45 percent minor soils.

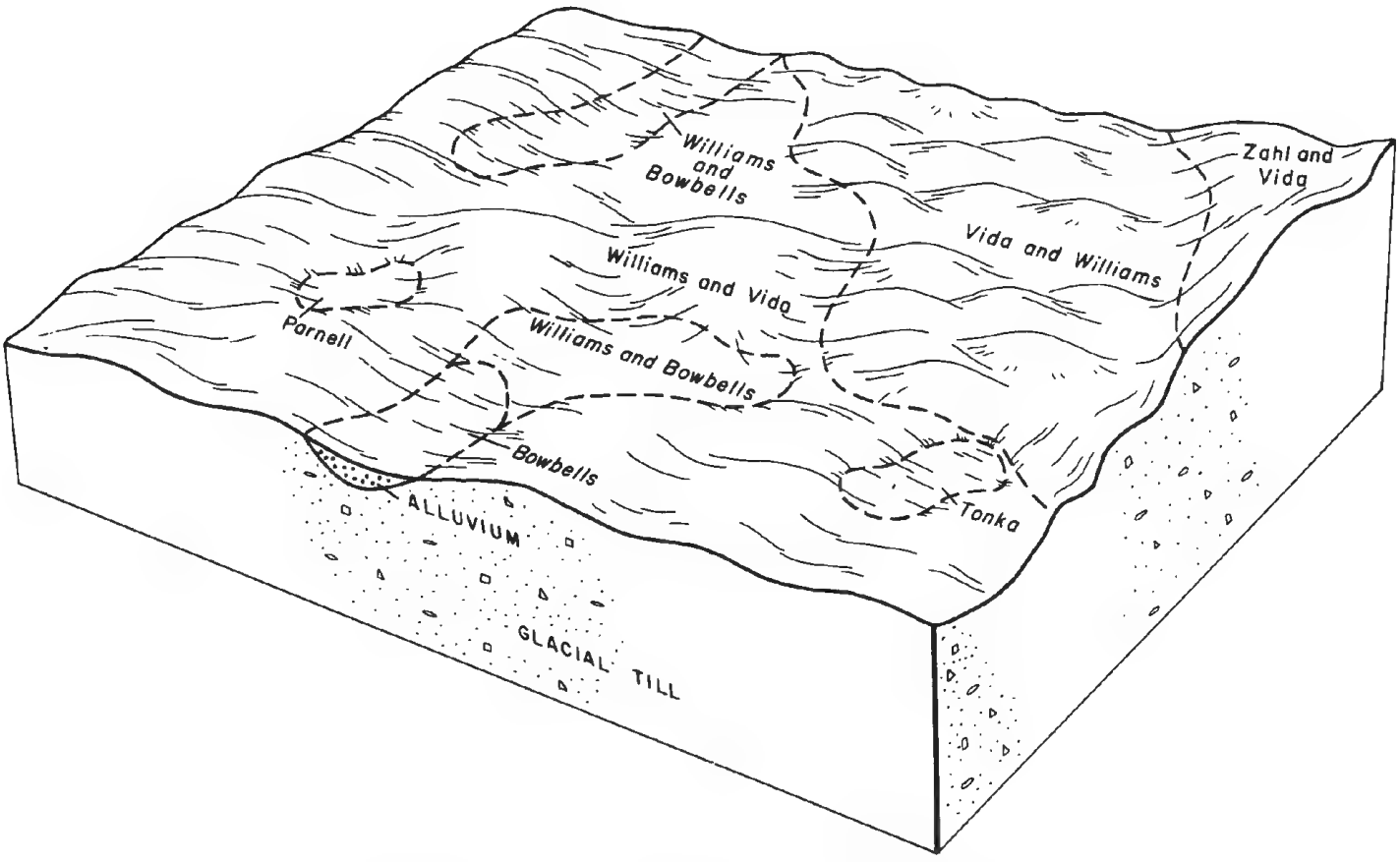


Figure 2.—Pattern of soils and topography in the Vida-Williams association.

Vida soils mainly are on the upper parts of the landscape. Slopes range from 3 to 25 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is friable clay loam. It is dark grayish brown in the upper part and grayish brown and calcareous in the lower part. The underlying material is light brownish gray, calcareous clay loam.

Williams soils mainly are on the mid and lower parts of the landscape. Slopes range from 0 to 9 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is brown and grayish brown, friable clay loam. It is calcareous in the lower part. The underlying material is light brownish gray, calcareous clay loam.

Minor in this association are the moderately well drained Bowbells and well drained Zahl soils, which are the most extensive of the minor soils. The Bowbells soils are on the lower parts of nearly level areas and in swales. The Zahl soils have lime near the surface. They are on the upper parts of strongly sloping to steep areas. Other minor soils in this association are the well drained silty Bryant soils, which occur as areas intermingled with areas of the Vida and Williams soils; the somewhat excessively drained Lehr and excessively drained Wabek soils on ridgetops; and the very poorly drained Parnell and poorly drained Tonka soils in closed depressions.

About 65 percent of this association is rangeland, tame pasture, and hayland. The rest is used for corn, small grain, and alfalfa. The main concerns of management are conserving moisture, controlling erosion, and maintaining fertility. Terracing and contouring are not suitable in most areas because of short, irregular slopes and small lakebeds and depressions.

This association generally has good potential for tame pasture, hay, and rangeland and for rangeland wildlife habitat. It generally has fair potential for cultivated crops, building sites, and most sanitary facilities.

11. Williams-Bowbells association

Deep, well drained and moderately well drained, nearly level to moderately sloping loamy soils on uplands and in upland swales

This association is on a glacial till plain (fig. 3). Slopes generally are nearly level to undulating, but steeper areas are on the sides of the higher ridges and around some closed depressions. Scattered stones are on the surface and throughout most of the soils.

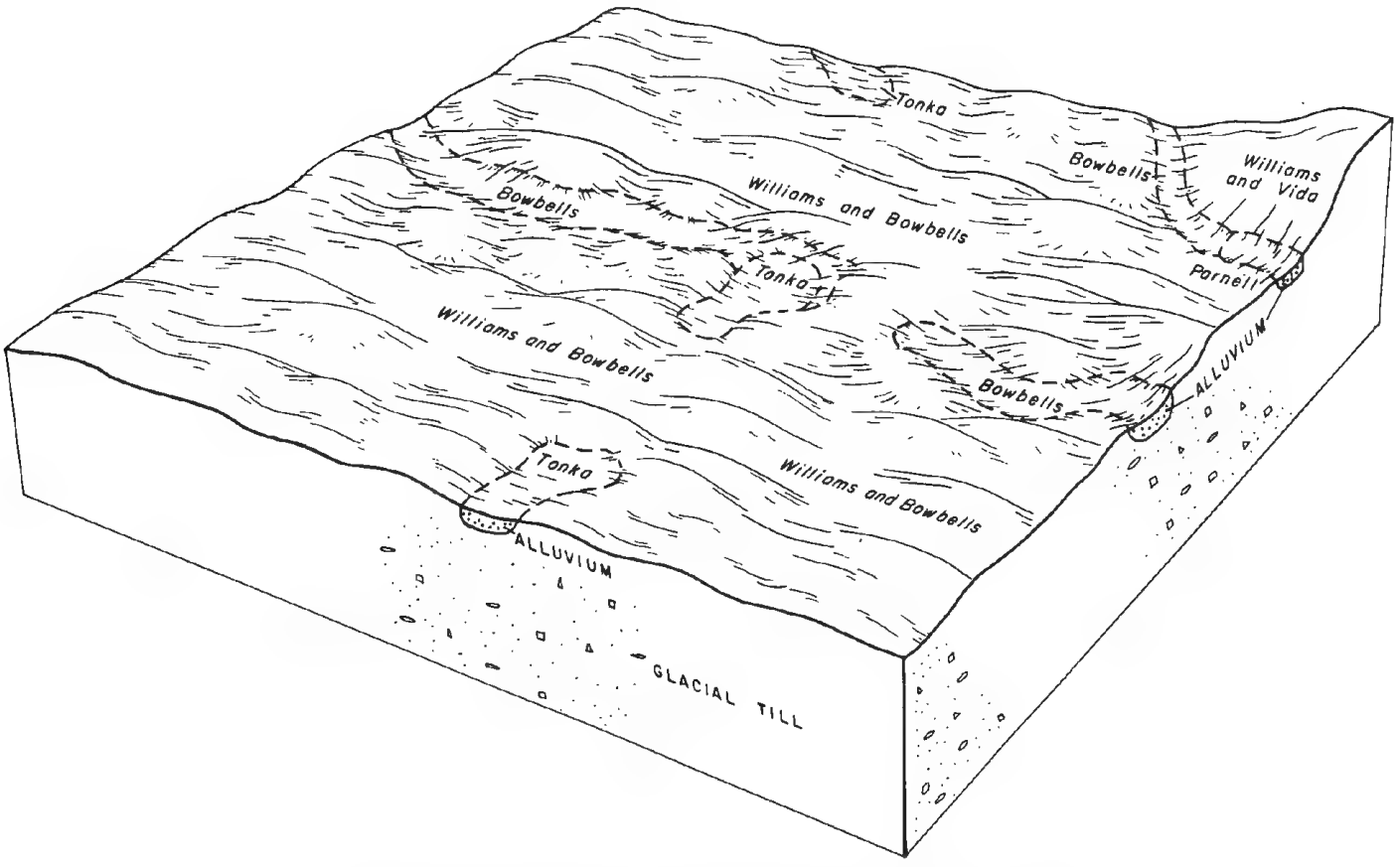


Figure 3.—Pattern of soils and topography in the Williams-Bowbells association.

This association makes up about 22 percent of the county. It is about 35 percent Williams soils, 25 percent Bowbells soils, and 40 percent minor soils.

The well drained Williams soils are on gentle rises. Slopes range from 0 to 9 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is brown and grayish brown, friable clay loam. It is calcareous in the lower part. The underlying material is light brownish gray, calcareous clay loam.

The moderately well drained Bowbells soils are on the lower slightly concave parts of the landscape and in swales. Slopes generally are less than 3 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is dark grayish brown and grayish brown, friable clay loam. The underlying material is grayish brown, calcareous clay loam.

Minor in this association are the well drained silty Bryant soils, which occur as areas intermingled with areas of the Williams soils; the poorly drained Tonka and very poorly drained Parnell soils in closed depressions; and the well drained Vida soils, which have lime within 10 inches of the surface and occur as areas intermingled with areas of the Williams soils on the higher parts of the landscape.

About 65 percent of this association is used for cultivated crops and tame pasture or hay. Corn, alfalfa, and small grain are the main crops. Some of the steeper areas support native grass and are used for grazing or hay. The main concerns of management are conserving moisture, maintaining fertility, and controlling erosion on the steeper slopes.

This association has good potential for most cultivated crops, for tame pasture and hay, for rangeland, and for openland wildlife habitat. The Williams soils have fair potential for most building sites and sanitary facilities. The Bowbells soils have poor potential for building sites and most sanitary facilities because of flooding.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils having profiles that are almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. The Bowdle series, for example, was named for the town of Bowdle in Edmunds County.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Bowdle loam, 3 to 6 percent slopes, is one of several phases within the Bowdle series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Williams-Bowbells loams, 0 to 3 percent slopes, is an example.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Pits, gravel, is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 4, and additional information on properties, limitations, capabilities, and potentials for

many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

The names of some map units on the detailed soil maps do not coincide exactly with those in the published surveys of Edmunds and Walworth Counties, South Dakota, because of differences in the design of map units and because of changes in the application of the soil classification system.

1A—Bowbells loam. This deep, moderately well drained, nearly level soil is in upland swales. It is frequently flooded for very brief periods. It is in areas that range from 5 to 150 acres in size. Slopes are smooth and slightly concave.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is about 15 inches of friable clay loam. It is dark grayish brown in the upper part and grayish brown in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous clay loam.

Included with this soil in mapping are small areas of Tonka and Williams soils. These soils make up less than 15 percent of any one mapped area. The Tonka soil is in closed depressions less than 5 acres in size and is poorly drained. The Williams soil is on the higher parts of the landscape and is well drained.

Permeability is moderate in the subsoil of the Bowbells soil and moderately slow in the underlying material. Available water capacity is high. This soil is high in organic matter content and in fertility. The subsoil has a moderate shrink-swell potential. The water table is at a depth of 4 to 6 feet during wet periods. Runoff is slow.

Most areas are farmed. Some areas support native grass and are used for grazing or hay. This soil has good potential for cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings. It has poor potential for building sites and most sanitary facilities.

This soil is well suited to small grain, corn, and other crops. It also is well suited to alfalfa, intermediate wheatgrass, and smooth bromegrass for tame pasture and hay. Farming is delayed in some years because of the wetness caused by runoff from the adjacent uplands. Crop residue management and stubble mulching conserve moisture and help to maintain fertility.

This soil is well suited to rangeland. The natural plant cover dominantly is big bluestem and lesser amounts of switchgrass. In overused areas, the natural grasses lose vigor and are replaced by western wheatgrass and Kentucky bluegrass.

This soil is well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs can grow well. Competing vegetation hinders the survival and growth of plantings. It can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

This soil is poorly suited to building site development and most sanitary facilities because of flooding. Capability unit IIc-3; Overflow range site.

2—Grail silty clay loam. This deep, well drained, nearly level soil is on uplands. It is on long and narrow or irregularly shaped swales and terraces. Areas range from 10 to 350 acres in size. Slopes are smooth or slightly concave.

Typically, the surface layer is dark gray silty clay loam about 6 inches thick. The subsoil is about 32 inches thick. It is dark gray, firm silty clay loam in the upper part and grayish brown, calcareous silty clay in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous silty clay loam. In places, the subsoil contains more clay. In some areas, the subsoil is lighter colored.

Included with this soil in mapping are small areas of Farnuf, Noonan, and Ranslo soils. These soils make up less than 15 percent of any one mapped area. The Farnuf soils contain less clay than the Grail soils. They are on the higher parts of the landscape. The Noonan and Ranslo soils are on the lower parts of the landscape. They have a dense, compact subsoil.

Permeability is moderately slow in the Grail soil. Available water capacity is high. This soil is high in organic matter content and in fertility. The subsoil has a high shrink-swell potential. Runoff is slow.

Most areas are farmed. Some areas support native grass and are used for grazing or hay. This soil has good potential for cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings. It has fair potential for most sanitary facilities and poor potential for most building sites.

This soil is well suited to small grain, corn, and other crops. It also is well suited to alfalfa, intermediate wheatgrass, and smooth bromegrass for tame pasture and hay. In cultivated areas, the surface tends to crust or puddle after hard rains. Farming is delayed in some years because of the wetness caused by runoff from adjacent uplands. The main concern of management is a periodic shortage of moisture during the growing season. Crop residue management and stubble mulching conserve moisture and help to maintain fertility.

This soil is well suited to rangeland. The natural plant cover dominantly is big bluestem and lesser amounts of switchgrass. In overused areas, the natural grasses lose vigor and are replaced by western wheatgrass and Kentucky bluegrass.

This soil is well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs can grow well. Competing vegetation hinders the survival and growth of plantings. It can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

If buildings are constructed on this soil, the foundations and footings should be reinforced to prevent the structure damage caused by shrinking and swelling. Enlarging the absorption area helps overcome the slow absorption of liquid waste in septic tank absorption fields. Capability unit IIc-3; Overflow range site.

4—Grassna silt loam. This deep, moderately well drained, nearly level soil is in swales on uplands. It is frequently flooded for very brief periods. It is in long and narrow or irregularly shaped areas that range from 5 to 100 acres in size. Slopes are smooth and slightly concave.

Typically, the surface layer is very dark gray silt loam about 13 inches thick. The subsoil is about 17 inches of friable silt loam. It is dark brown in the upper part and grayish brown in the lower part. The underlying material to a depth of 60 inches is light brownish gray and light yellowish brown, calcareous silt loam.

Included with this soil in mapping are small areas of Bryant, Linton, and Tonka soils. These soils make up less than 15 percent of any one mapped area. The Bryant and Linton soils are on the higher parts of the landscape and are well drained. The Tonka soils are in closed depressions less than 5 acres in size and are poorly drained.

Permeability is moderate in the Grassna soil. Available water capacity is high. This soil is high in organic matter content and in fertility. The subsoil has a moderate shrink-swell potential. The water table is at a depth of 4 to 6 feet during wet periods. Runoff is slow.

Most areas are farmed. Some areas support native grass and are used for grazing or hay. This soil has good potential for cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings. It has poor potential for building site development and most sanitary facilities.

This soil is well suited to small grain, corn, and other crops. It also is well suited to alfalfa, intermediate wheatgrass, and smooth bromegrass for tame pasture and hay. In some years, farming is delayed because of the wetness caused by runoff from adjacent uplands. Crop residue management and stubble mulching conserve moisture and help to maintain fertility.

This soil is well suited to rangeland. The natural plant cover dominantly is big bluestem and lesser amounts of switchgrass. In overused areas, the natural grasses lose vigor and are replaced by western wheatgrass and Kentucky bluegrass.

This soil is well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs can grow well. The survival and growth of plantings can be enhanced by fallowing a year prior to planting, by cultivating, and by applying herbicides.

The adjacent well drained soils should be selected as building sites. The Grassna soil is poorly suited to building site development and septic tank absorption fields because it is subject to flooding. Capability unit IIc-3; Overflow range site.

5—Williams-Noonan loams, 0 to 4 percent slopes. These deep, nearly level and very gently sloping soils are on uplands. They are well drained and moderately well drained. Slopes are smooth and convex. Areas are irregularly shaped and range from 5 to 80 acres in size. They are 45 to 55 percent Williams soil and 30 to 40 percent Noonan soil. These soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Williams soil has a surface layer of dark grayish brown loam about 6 inches thick. The subsoil is about 19 inches of friable clay loam. It is brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has spots of lime that extend into the underlying material. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam. In places, the subsoil contains less clay. In some convex areas, lime is nearer the surface.

Typically, the Noonan soil has a surface layer of very dark grayish brown loam about 6 inches thick. The subsurface layer is grayish brown silt loam about 3 inches thick. The subsoil is about 10 inches of clay loam. It is dark brown in the upper part and grayish brown in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam. It has streaks and nests of lime and salts. In some small, low areas, the surface layer is thinner.

Included with these soils in mapping are small areas of Bowbells and Tonka soils. These included soils make up less than 25 percent of any one mapped area. The Bowbells soils are in swales. They contain less sodium than the Williams and Noonan soils. The Tonka soils are in closed depressions less than 5 acres in size and are poorly drained.

Permeability is moderate in the upper part of the Williams soil and moderately slow in the underlying material. It is slow in the Noonan soil. Available water capacity is high. Both soils are moderate in organic matter content and medium in fertility. The shrink-swell potential is moderate in the subsoil of the Williams soil and high in the subsoil of the Noonan soil. Runoff is medium.

Most areas support native grass. Some areas are farmed. The Williams soil has good potential and the Noonan soil fair potential for cultivated crops, tame pasture and hay, and rangeland. The Williams soil has good potential and the Noonan soil poor potential for windbreaks and environmental plantings. Both soils have fair potential for most kinds of building site development and for sanitary facilities.

These soils are best suited to rangeland. The native vegetation on the Williams soil is bluestems, western wheatgrass, and green needlegrass. That on the Noonan soil dominantly is western wheatgrass and some blue grama. Overused areas of Williams soil are dominated by

western wheatgrass and needleandthread and overused areas of Noonan soil by blue grama and buffalograss.

If farmed, these soils are best suited to shallow rooted crops because the Noonan soil has a dense, compact subsoil that restricts root penetration, the downward movement of water, and thus the amount of water released to plants. Crop residue management, stubble mulching, and grasses and legumes in the cropping system improve water intake and conserve moisture.

If these soils are used for tame pasture or hay, the choice of plants and the productivity are somewhat limited by soluble salts and the restricted rooting in the subsoil of the Noonan soil. Suitable species for planting include alfalfa, crested wheatgrass, and intermediate wheatgrass.

The Williams soil is well suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs can grow well. The Noonan soil is poorly suited to windbreaks and environmental plantings. Trees and shrubs can be established on this soil if the proper species are selected. Optimum survival, growth, and vigor, however, are unlikely.

The Williams soil should be selected as a site for buildings. Reinforcing foundations and footings helps to prevent the structure damage caused by the shrinking and swelling of this soil. Enlarging septic tank absorption fields helps overcome the slow absorption of liquid waste in both soils. Williams soil in capability unit IIe-2, Silty range site; Noonan soil in capability unit IVs-2, Claypan range site.

7A—Hamerly silt loam, 0 to 3 percent slopes. This deep, somewhat poorly drained, nearly level soil is in swales and on flats that surround closed depressions. It is in areas that are long and narrow or irregularly shaped and range from 5 to 50 acres in size. Slopes are smooth or slightly concave.

Typically, the surface layer is dark gray, calcareous silt loam about 11 inches thick. The next 12 inches is light brownish gray, friable, calcareous loam. Below this to a depth of 60 inches is mottled, calcareous, light yellowish brown and light brownish gray clay loam or loam.

Included with this soil in mapping are small areas of Tonka and Williams soils. These soils make up less than 15 percent of any one mapped area. The Tonka soils are in closed depressions less than 5 acres in size and are poorly drained. The Williams soils are on the higher parts of the landscape and are well drained. Their surface layer does not contain lime.

Permeability is moderate in the upper part of the Hamerly soil and moderately slow in the lower part. Available water capacity is high. This soil is moderate in organic matter content and is medium in fertility. The shrink-swell potential is moderate. The surface layer contains lime. The water table is at a depth of 1.5 to 3.0 feet during wet years. Runoff is slow.

Because this soil occurs as long, narrow areas, its use is the same as that of adjacent soils. Many areas are farmed. Some areas support native grass and are used for grazing or hay. This soil has good potential for cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings. It has poor potential for sanitary facilities and most building sites.

This soil is suited to all of the cultivated crops commonly grown in the county. It is well suited to alfalfa, intermediate wheatgrass, and smooth bromegrass for tame pasture and hay. The high content of lime in the surface layer adversely affects the availability of plant nutrients and increases the susceptibility to soil blowing, which is the main concern of management. Crop residue management, stripcropping, and stubble mulching help control soil blowing, conserve moisture, and maintain fertility.

This soil is well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs can grow well if competing vegetation is controlled. Fallowing a year before the trees or shrubs are planted, cultivating, and applying herbicides control competing vegetation and thus enhance the survival and growth of plantings.

Because it is wet, this soil is a poor site for buildings with basements. If buildings without basements are constructed, reinforcing the foundations and footings helps prevent the structure damage caused by the shrinking and swelling of the soil. This soil is too wet for sanitary facilities. Capability unit IIe-4; Silty range site.

7B—Hamerly silt loam, 3 to 6 percent slopes. This deep, somewhat poorly drained, gently sloping soil is on the upper parts of the landscape surrounding closed depressions. It is in areas that are long and narrow or irregularly shaped and range from 5 to 50 acres in size. Slopes are short and convex.

Typically, the surface layer is dark gray, calcareous silt loam about 11 inches thick. The next 12 inches is light brownish gray, friable, calcareous loam. Below this to a depth of 60 inches is calcareous, light yellowish brown and light brownish gray, mottled clay loam or loam.

Included with this soil in mapping are small areas of Bowbells and Williams soils. These soils make up less than 10 percent of any one mapped area. Their surface layer does not contain lime. The moderately well drained Bowbells soils are on the lower parts of the landscape. The well drained Williams soils are on the higher parts of the landscape.

Permeability is moderate in the upper part of the Hamerly soil and moderately slow in the lower part. Available water capacity is high. This soil is moderate in organic matter content and is medium in fertility. The shrink-swell potential is moderate. The surface layer contains lime. The water table is at a depth of 1.5 feet to 3.0 feet during wet years. Runoff is medium.

Because this soil occurs as long, narrow areas, its use is the same as that of adjacent soils. Many areas are farmed. Some areas support native grass and are used for grazing or hay. This soil has good potential for cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings. It has poor potential for sanitary facilities and most building sites.

This soil is suited to all of the cultivated crops commonly grown in the county. It also is suited to alfalfa, intermediate wheatgrass, and smooth bromegrass for tame pasture and hay. The high content of lime in the surface layer adversely affects the availability of plant nutrients and increases the susceptibility to soil blowing. The main concerns of management are erosion and soil blowing. Crop residue management, stubble mulching, and stripcropping help control erosion and soil blowing, conserve moisture, and maintain fertility.

The native vegetation is bluestems, green needlegrass, and lesser amounts of western wheatgrass. Overgrazed rangeland is dominated by western wheatgrass, blue grama, and needleandthread.

This soil is well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs can grow well. Competing vegetation hinders the survival and growth of plantings. It can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

Because it is wet, this soil is a poor site for buildings with basements. If buildings without basements are constructed, reinforcing the foundations and footings helps prevent the structure damage caused by the shrinking and swelling of the soil. This soil is too wet for sanitary facilities. Capability unit IIIe-11; Silty range site.

9C—Seroco loamy fine sand, 2 to 15 percent slopes. This deep, excessively drained, very gently sloping to rolling soil is on outwash plains and terraces. Areas are irregularly shaped and range from 5 to 50 acres in size. Slopes are short and convex.

Typically, the surface layer is dark grayish brown loamy fine sand about 3 inches thick. The underlying material to a depth of 60 inches is brown, loose fine sand.

Included with this soil in mapping are small areas of the well drained Maddock and Tally soils. These soils make up less than 10 percent of any one mapped area. They are on the lower parts of the landscape.

Permeability is rapid in the Seroco soil. Available water capacity is low. This soil is low in organic matter content and fertility. Runoff is very slow.

This soil supports native grass and is used for grazing or hay. It has good potential for rangeland and fair potential for windbreaks and environmental plantings and most kinds of building site development. The potential is poor for cultivated crops and tame pasture and hay because soil blowing is a very severe hazard. The potential also is poor for most sanitary facilities.

The natural plant cover mainly is sand bluestem, little bluestem, and prairie sandreed. Overgrazed rangeland is dominated by prairie sandreed and threadleaf sedge. Excessive overuse results in an increase in the extent of prairie sandreed and bare areas and severe soil blowing. A planned grazing system that includes proper grazing use and deferred grazing is necessary to help keep native grass in good condition and maintain the stability of the underlying sand.

This soil is suited to trees. It is better suited to evergreen trees than to deciduous trees. Keeping cultivation to a minimum helps to control soil blowing. Planting trees directly in sod or stubble also helps to control soil blowing.

This soil is suited to building site development. Some land leveling is needed, however, in the strongly sloping areas. The effluent from sanitary facilities can pollute shallow ground water. Capability unit VIe-7; Sands range site.

9E—Seroco-Dune land complex. This map unit consists of deep, excessively drained, moderately sloping to hilly soils and bare sandy areas on uplands. The areas are irregularly shaped and range from 5 to 100 acres in size. They are about 45 to 55 percent Seroco soil and 35 to 45 percent Dune land. The Seroco soil and Dune land occur as areas so intermingled that it is not practical to separate them in mapping.

Typically, the Seroco soil has a surface layer of dark grayish brown loamy fine sand about 3 inches thick. The underlying material to a depth of 60 inches is brown, loose fine sand. The Dune land is fine sand that has no plant cover.

Included with this unit in mapping are small areas of the well drained Maddock and somewhat poorly drained Wyndmere soils. These soils make up less than 25 percent of any one mapped area. They are on the lower parts of the landscape.

Permeability is rapid in the Seroco soil. Available water capacity is low. This soil is low in organic matter content and in fertility. Runoff is very slow.

Most areas support native grass and are used for grazing. The Seroco soil has fair potential for rangeland and poor potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, sanitary facilities, and most kinds of building site development.

The natural plant cover mainly is sand bluestem, little bluestem, and prairie sandreed. Overgrazed rangeland is dominated by prairie sandreed and threadleaf sedge. Excessive overuse results in bare areas and severe soil blowing. Proper grazing use and deferred grazing are necessary to help keep the native grass in good condition and maintain the stability of the underlying sand.

This map unit generally is unsuited to cultivated crops and tame pasture and hay because of a very severe soil blowing hazard. It generally is unsuited to windbreaks but is suitable for special plantings of evergreen trees.

The Seroco soil generally is too steep for buildings and sanitary facilities. The Dune land is generally unsuitable as a site for most kinds of construction. Seroco soil in capability unit VIIe-1, Sands range site; Dune land in capability unit VIIIs-2, not assigned to a range site.

10—Hurley silt loam, 0 to 6 percent slopes. This moderately deep and deep, moderately well drained, nearly level to gently sloping soil is on toe slopes and in swales on uplands. It is in areas that are long and narrow or irregularly shaped and range from 5 to 200 acres in size. Slopes are smooth or slightly concave. A few bare spots are in the slightly concave areas.

Typically, the surface layer is light brownish gray silt loam about 2 inches thick. The subsoil is about 9 inches of extremely firm and very firm clay. It is grayish brown in the upper part and light brownish gray in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay that has nests of salts.

Included with this soil in mapping are small areas of Opal and Promise soils. These soils make up less than 15 percent of any one mapped area. They have less sodium in the subsoil than the Hurley soil. They are on the upper parts of the landscape.

Permeability is very slow in the Hurley soil. Available water capacity is low. This soil is moderate or low in organic matter content and low in fertility. It has a high shrink-swell potential. It has a dense claypan subsoil that restricts the penetration of roots. Runoff is medium.

Most areas support native grass and are used for grazing. A few small areas are farmed with adjacent soils. This soil has poor potential for cultivated crops, rangeland, tame pasture and hay, windbreaks and environmental plantings, building sites, and most sanitary facilities.

The natural plant cover dominantly is western wheatgrass, blue grama, and a small amount of pricklypear cactus. On overused rangeland, the wheatgrass is replaced by blue grama, buffalograss, pricklypear cactus, and saltgrass. If overuse continues, the extent of bare areas increases, especially during dry periods. The extent of weeds and pricklypear cactus also increases. The penetration of plant roots is severely restricted by the claypan subsoil.

This soil generally is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The thin surface layer, the dense, compact subsoil, and the salts in the lower part of the subsoil are the main limitations.

This soil generally is unsuited to building site development because of the high shrink-swell potential and to septic tank absorption fields because of the very slow permeability. Lagoons and holding tanks are alternate waste disposal systems. Capability unit VIs-1; Thin Claypan range site.

11—Hurley-Slickspots complex, 0 to 6 percent slopes. This map unit consists of moderately deep and deep, moderately well drained soils and small bare areas on toe slopes and along drainageways. It is nearly level and gently sloping. Slopes are slightly concave or smooth. Small depressions are common. Areas are long and narrow or irregularly shaped and range from 5 to 200 acres in size. They are 45 to 55 percent Hurley soil and 30 to 40 percent Slickspots. The Hurley soil is in vegetated areas, and the Slickspots are bare or very sparsely vegetated. The Hurley soil and Slickspots occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Hurley soil has a surface layer of light brownish gray silt loam about 2 inches thick. The subsoil is about 9 inches of very firm clay. It is grayish brown in the upper part and light brownish gray in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay that has nests of salts.

The Slickspots occur as areas that are puddled or crusted and very smooth. They have a nearly impervious surface that supports very little or no vegetation. To a depth of 60 inches, they are dense and massive clay.

Included with this unit in mapping are small areas of the well drained Opal and Promise soils. These soils make up less than 25 percent of any one mapped area. They are on the higher parts of the landscape or occur as areas intermingled with areas of the Hurley soil.

Permeability is very slow in the Hurley soil. Available water capacity is low. The Hurley soil is moderate or low in organic matter content and low in fertility. The shrink-swell potential is high. The sodium content and the dense compact subsoil of the Hurley soil and the impervious material of the Slickspots restrict the penetration of roots and the downward movement of water. Runoff is medium.

Most areas support native grass and are used for grazing. The Hurley soil has poor potential for cultivated crops, rangeland, tame pasture and hay, windbreaks and environmental plantings, building sites, and most sanitary facilities.

The natural plant cover on the Hurley soil dominantly is western wheatgrass, blue grama, and a small amount of pricklypear cactus. On overused rangeland, the wheatgrass is replaced by pricklypear cactus and short grasses, such as blue grama, buffalograss, and saltgrass. The Slickspots commonly have no plant cover.

This map unit generally is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The main limitations are the thin surface layer, the dense, compact subsoil and underlying material, and the salts in the lower part of the subsoil and in the underlying material.

This map unit generally is unsuitable as a building site because of the high shrink-swell potential and as a septic tank absorption field because of the restricted permeability. Lagoons and holding tanks are alternate

waste disposal systems. Hurley soil in capability unit VIs-1, Thin Claypan range site; Slickspots in capability unit VIIIs-2, not assigned to a range site.

13A—Tally fine sandy loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are irregular in shape and range from 10 to 250 acres in size. Slopes are smooth and convex.

Typically, the surface layer is dark grayish brown fine sandy loam about 7 inches thick. The subsoil is about 7 inches of brown, very friable fine sandy loam. The underlying material to a depth of 60 inches is grayish brown, calcareous fine sandy loam and loamy fine sand.

Included with this soil in mapping are small areas of Maddock, Parshall, and Tonka soils. These soils make up less than 10 percent of any one mapped area. The sandy Maddock soils are on the upper sides and tops of low rises. The Parshall soils have dark colors below a depth of 16 inches. They are in swales. The Tonka soils are in closed depressions less than 5 acres in size and are poorly drained.

Permeability is moderately rapid in the Tally soil. Available water capacity is moderate. Organic matter content also is moderate, and fertility is medium. Runoff is slow.

Most areas are farmed. Some areas are used for grazing or hay. This soil has good potential for cultivated crops, tame pasture and hay, rangeland, windbreaks and environmental plantings, and most building sites. It has poor potential for most sanitary facilities.

This soil is well suited to all of the crops commonly grown in the county. Spring grain, corn, and alfalfa are the main crops. Controlling soil blowing is the main concern of management. Conserving moisture and maintaining fertility are other concerns. Crop residue management, stripcropping, and stubble mulching help control soil blowing, conserve moisture, and maintain fertility.

This soil is well suited to tame pasture and hay. Suitable species for planting include alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass.

This soil is well suited to rangeland. The natural plant cover dominantly is bluestems and prairie sandreed. Needleandthread, blue grama, and western wheatgrass are less extensive. Overused areas are dominated by prairie sandreed, needleandthread, blue grama, and Kentucky bluegrass.

Except for those trees and shrubs that can grow well only if the moisture supply is abundant, most of the climatically adapted windbreaks and environmental plantings can grow well on this soil if competing vegetation is controlled. Fallowing a year before the trees or shrubs are planted, cultivating, and applying herbicides control plant competition.

This soil is well suited to most kinds of building site development. Septic tank absorption fields function well, but the effluent from all sanitary facilities can pollute shallow ground water. Capability unit IIIe-7; Sandy range site.

13B—Tally fine sandy loam, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and range from 5 to more than 600 acres in size. Slopes are smooth and convex.

Typically, the surface layer is dark grayish brown fine sandy loam about 7 inches thick. The subsoil is about 7 inches of brown, very friable fine sandy loam. The underlying material to a depth of 60 inches is grayish brown, calcareous fine sandy loam and loamy fine sand.

Included with this soil in mapping are small areas of Maddock, Parshall, Tonka, Williams, and Yecross soils. These soils make up less than 15 percent of any one mapped area. The sandy Maddock and Yecross soils are on the upper sides and tops of low rises. The Parshall soils have dark colors below a depth of 16 inches. They are in swales. The Tonka soils are in closed depressions less than 5 acres in size and are poorly drained. The Williams soils contain more clay than the Tally soil and occur as areas intermingled with some areas of that soil.

Permeability is moderately rapid in the Tally soil. Available water capacity is moderate. Organic matter content also is moderate, and fertility is medium. Runoff is medium.

Most areas are farmed. Some areas are used for grazing or hay. This soil has good potential for cultivated crops, tame pasture and hay, rangeland, windbreaks and environmental plantings, and most building sites. It has poor potential for most sanitary facilities.

This soil is well suited to all of the crops commonly grown in the county. Spring grain, corn, and alfalfa are the main crops. Controlling soil blowing and erosion is the main concern of management. Conserving moisture and maintaining fertility are other concerns. Crop residue management, stripcropping, and stubble mulching help control soil blowing and erosion, maintain fertility, and conserve moisture.

The growth of tame pasture plants is somewhat limited by the moderate available water capacity and severe soil blowing. Suitable species for planting include alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass.

The natural plant cover dominantly is bluestems and prairie sandreed. Needleandthread, blue grama, and western wheatgrass are less extensive. Overused rangeland is dominated by prairie sandreed, blue grama, needleandthread, and Kentucky bluegrass.

This soil is well suited to windbreaks and environmental plantings. Except for those trees and shrubs that can grow well only if the moisture supply is abundant, most of the climatically adapted species can grow well if competing vegetation is controlled. Fallowing a year before the trees or shrubs are planted, cultivating, and applying herbicides control plant competition.

This soil is well suited to most kinds of building site development. Septic tank absorption fields function well, but the effluent from all sanitary facilities can pollute

shallow ground water. Capability unit IIIe-8; Sandy range site.

13C—Tally fine sandy loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on uplands. Areas are irregular in shape and range from 5 to 100 acres in size. Slopes are smooth and convex.

Typically, the surface layer is dark grayish brown fine sandy loam about 7 inches thick. The subsoil is about 7 inches of brown, very friable fine sandy loam. The underlying material to a depth of 60 inches is grayish brown, calcareous fine sandy loam and loamy fine sand.

Included with this soil in mapping are small areas of Lehr, Parshall, Vida, and Yecross soils. These soils make up less than 15 percent of any one mapped area. The somewhat excessively drained Lehr and excessively drained Yecross soils are on the upper sides and tops of low hills and ridges. The Parshall soils have dark colors below a depth of 16 inches. They are on the lower parts of the landscape and in swales. The Vida soils contain more clay than the Tally soil. They occur as areas intermingled with some areas of that soil.

Permeability is moderately rapid in the Tally soil. Available water capacity is moderate. Organic matter content also is moderate, and fertility is medium. Runoff is medium.

Most areas support native grass and are used for grazing or hay. Some areas are farmed. This soil has good potential for rangeland, tame pasture and hay, and windbreaks and environmental plantings. It has fair potential for cultivated crops and most kinds of building site development and poor potential for most sanitary facilities.

The natural plant cover dominantly is bluestems and priairie sandreed. Needleandthread, blue grama, and western wheatgrass are less extensive. Overused rangeland is dominated by prairie sandreed, blue grama, needleandthread, and Kentucky bluegrass.

Controlling erosion and soil blowing is the main concern of management. Alfalfa, corn, and spring grain are the main crops. Crop residue management, stripcropping, and stubble mulching help control erosion and soil blowing and conserve moisture.

This soil is well suited to tame pasture and hay. Suitable species for planting include alfalfa, intermediate wheatgrass, and smooth bromegrass.

This soil is suited to windbreaks and environmental plantings. Except for those trees and shrubs that can grow well only if the moisture supply is abundant, most of the climatically adapted species can grow well. Planting trees on the contour helps control erosion. Competing vegetation can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides. Control of plant competition enhances the survival and growth of plantings.

This soil is suitable as a site for most buildings. Septic tank absorption fields function well, but the effluent from all sanitary facilities can pollute shallow ground water. Capability unit IVe-8; Sandy range site.

15—Harriet silt loam. This deep, poorly drained, nearly level soil is on flood plains. It is occasionally flooded for long periods. Areas are irregular in shape and range from 5 to more than 300 acres in size. Slopes are concave or plane. Small, slight depressions are in some areas.

Typically, the surface layer is gray silt loam about 2 inches thick. The subsoil is about 12 inches of dark gray, firm clay. In the lower part, it has nests of salts that extend into the underlying material. The underlying material to a depth of 60 inches is light gray and light brownish gray, calcareous silty clay. In places, this soil contains less clay.

Included with this soil in mapping are small areas of Ranslo soils. These soils make up less than 10 percent of any one mapped area. They are somewhat poorly drained and are on slight rises.

Permeability is slow in the Harriet soil. Available water capacity is moderate. This soil is moderate in organic matter content and is medium in fertility. It has a high shrink-swell potential. The water table is within a depth of 1 foot during wet periods. The subsoil has a high content of sodium. Runoff is slow.

Nearly all areas support native grass and are used for grazing or hay. This soil has poor potential for cultivated crops, rangeland, tame pasture and hay, windbreaks and environmental plantings, and most sanitary facilities.

The natural plant cover dominantly is alkali sacaton, saltgrass, and western wheatgrass. Overused rangeland is dominated by saltgrass and thin stands of western wheatgrass. Grazing during wet periods causes surface compaction. This compaction depletes the better grasses.

This soil generally is not suited to cultivated crops, tame pasture and hay, or windbreaks and environmental plantings. The dense and compact character of the subsoil, the high content of salts in the subsoil, and the flooding severely limit the choice of suitable species and the growth of plants.

This soil is not suitable as a site for buildings and most sanitary facilities because of wetness and flooding. Capability unit VIw-4; Saline Lowland range site.

16—Egas silty clay loam. This deep, poorly drained, nearly level soil is on flood plains. It is frequently flooded for brief periods. Areas are irregular in shape and range from 5 to 60 acres in size. Slopes are slightly concave or plane.

Typically, the surface layer is 9 inches of silty clay loam. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part has threads and nests of salts that extend into the underlying material. The next 15 inches is grayish brown, mottled, firm silty clay loam. Below this to a depth of 60 inches is

light brownish gray, mottled, calcareous silty clay loam or silty clay that has threads and nests of salts. In places, the subsoil contains more clay.

Included with this soil in mapping are small areas of Ranslo soils. These soils make up less than 10 percent of any one mapped area. They are somewhat poorly drained and are on slight rises. Also included are scattered small areas where the surface layer has a high content of salts and the surface is bare.

Permeability is slow in the Egas soil. Available water capacity is high. This soil is moderate in organic matter content and medium or low in fertility. It has a high shrink-swell potential. The water table is at the surface or within 1 foot of the surface during wet periods. The soil has a high content of salts throughout. Runoff is slow.

Nearly all areas support native grass and are used for grazing or hay. This soil has poor potential for cultivated crops, rangeland, tame pasture and hay, windbreaks and environmental plantings, building sites, and sanitary facilities.

The natural plant cover dominantly is saltgrass and lesser amounts of western wheatgrass. If rangeland is overused, the western wheatgrass is replaced by saltgrass. Also, the size of bare areas generally increases.

This soil is not suitable as a site for buildings and sanitary facilities because of the flooding and the wetness. Capability unit VIw-4; Saline Lowland range site.

17—Hecla loamy sand. This deep, moderately well drained, nearly level soil is on outwash plains. It is in irregularly shaped areas that range from 5 to 350 acres in size. Slopes are plane or slightly concave.

Typically, the surface layer is dark gray loamy sand about 16 inches thick. The next 7 inches is dark grayish brown, very friable loamy sand. The underlying material to a depth of 60 inches is grayish brown and light olive brown, calcareous fine sand and sand.

Included with this soil in mapping are small areas of Maddock, Parshall, and Yecross soils. These soils make up less than 15 percent of any one mapped area. The Maddock and Yecross soils are better drained than the Hecla soil and are on the upper parts of the landscape. The Parshall soils occur as areas intermingled with areas of the Hecla soil in swales and also are better drained.

Permeability is rapid in the Hecla soil. Available water capacity is low. This soil is moderate in organic matter content and medium in fertility. The seasonal high water table is at a depth of 3 to 6 feet. Runoff is slow.

Most areas support native grass and are used for grazing or hay. This soil has good potential for rangeland, tame pasture and hay, and windbreaks and environmental plantings. It has fair potential for cultivated crops and building sites and poor potential for most sanitary facilities.

The natural plant cover mainly is sand bluestem, little bluestem, and prairie sandreed. Overused rangeland is dominated by prairie sandreed and threadleaf sedge. On continually overused rangeland, prairie sandreed is dominant, some areas are bare, and soil blowing is a serious problem.

Controlling soil blowing and conserving moisture are the main concerns of management if this soil is farmed. Crop residue management, stripcropping, stubble mulching, and grasses and legumes in the cropping system conserve moisture and help to control soil blowing. Suitable species for tame pasture or hay are crested wheatgrass, intermediate wheatgrass, and smooth bromegrass.

This soil is well suited to windbreaks and environmental plantings. Trees and shrubs that require an abundant supply of moisture grow well because of the high water table. Competing vegetation hinders the survival and growth of plantings. It can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

This soil is well suited to most kinds of building site development. Drainage is needed if buildings with basements are constructed. The soil is poorly suited to sanitary facilities because of wetness and seepage. Capability unit IVe-9; Sands range site.

18—Parshall fine sandy loam. This deep, well drained, nearly level soil is on uplands. Areas are long and narrow or irregular in shape and range from 5 to 150 acres in size. Slopes are smooth and slightly concave.

Typically, the surface layer is dark grayish brown fine sandy loam about 11 inches thick. The subsoil is about 24 inches of very friable fine sandy loam. It is dark grayish brown in the upper part and brown in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous loamy fine sand.

Included with this soil in mapping are small areas of Maddock, Tally, and Yecross soils. These soils make up less than 15 percent of any one mapped area. They are on the higher parts of the landscape. They do not have dark colors below a depth of 16 inches.

Permeability is moderately rapid in the Parshall soil. Available water capacity is moderate. This soil is moderate in organic matter content and medium in fertility. Runoff is slow.

Most areas are farmed. Some areas support native grass and are used for grazing or hay. This soil has good potential for cultivated crops, rangeland, windbreaks and environmental plantings, tame pasture and hay, and most building sites. It has poor potential for most sanitary facilities.

This soil is suited to most of the crops commonly grown in the county. Conserving moisture and controlling soil blowing are the main concerns of management. Crop residue management, stripcropping, and stubble mulching help control soil blowing, conserve moisture, and maintain fertility.

This soil is well suited to tame pasture and hay. Suitable species for planting include alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass.

This soil is well suited to rangeland. The natural plant cover dominantly is bluestems. Prairie sandreed, needleandthread, blue grama, and western wheatgrass are less extensive. Overused areas are dominated by prairie sandreed, needleandthread, blue grama, and Kentucky bluegrass.

This soil is well suited to all of the climatically adapted trees and shrubs. Fallowing a year before the trees or shrubs are planted, cultivating, and applying herbicides help control competing vegetation and thus enhance the survival and growth of plantings.

This soil is well suited to building site development and septic tank absorption fields. The effluent from all sanitary facilities, however, can pollute shallow ground water. Capability unit IIIe-7; Sandy range site.

19—Heil silt loam. This deep, poorly drained, level soil is in shallow, closed depressions in the uplands. It is frequently flooded for long periods. It is in areas that are circular or irregularly shaped and range from 5 to 100 acres in size.

Typically, the surface layer is gray silt loam about 1 inch thick. The subsoil is about 21 inches of dark gray, very firm silty clay. The underlying material to a depth of 60 inches is calcareous silty clay. It is dark gray in the upper part and gray in the lower part. In places, the surface layer is thicker and darker colored.

Included with this soil in mapping are small areas of Bowbells and Williams soils. These soils make up less than 5 percent of any one mapped area. They are better drained than the Heil soil and are on the edges of the depressions.

Permeability is very slow in the Heil soil. Available water capacity is moderate. This soil is moderate in organic matter content and low or medium in fertility. The subsoil has a high shrink-swell potential. It is a dense claypan that restricts root penetration. The water table is within a depth of 1 foot during wet periods. In some of these periods, it is half a foot above the surface. The soil is ponded during the spring in most years.

Most areas support native grass and are used for grazing or hay. Many small areas are farmed with adjacent soils. This soil has fair potential for rangeland and for tame pasture and hay. It generally is unsuited to windbreaks and environmental plantings. It has poor potential for cultivated crops, building sites, and most sanitary facilities.

This soil is best suited to rangeland. The natural plant cover dominantly is western wheatgrass and lesser amounts of bluegrass and saltgrass and sedges and forbs. Overused areas are dominated by Kentucky bluegrass and saltgrass. The extent of sedges increases during wet periods and that of buffalograss during dry periods. The soil puddles if it is grazed when wet. The puddling results in an increase in the extent of the less desirable plants.

This soil generally is unsuitable as cropland. The thin surface layer, the dense, compact subsoil, and the ponding are the main limitations.

The choice of tame pasture plants is limited because natural drainage is restricted and artificial drainage is not feasible. The thin surface layer and the dense, compact subsoil limit the choice of plants to western wheatgrass.

This soil generally is unsuited to windbreaks or environmental plantings. The inadequate drainage and the dense, compact subsoil severely limit the growth and survival of these plantings.

This soil generally is unsuitable as a site for buildings and most sanitary facilities because of flooding, wetness, and restricted permeability. Capability unit VIs-1; Closed Depression range site.

20D—Sully silt loam, 9 to 25 percent slopes. This deep, well drained, strongly sloping and moderately steep soil is on uplands. Areas are irregular in shape and range from 5 to 100 acres in size. Slopes are smooth and convex.

Typically, the surface layer is grayish brown, calcareous silt loam about 3 inches thick. The underlying material to a depth of 60 inches is light brownish gray. It is calcareous silt loam in the upper part and very fine sandy loam in the lower part.

Included with this soil in mapping are small areas of Flasher, Linton, Sansarc, and Zahl soils. These soils make up less than 15 percent of any one mapped area. The somewhat excessively drained Flasher soils are on the top of ridges and knolls. The Linton soils do not have lime in the surface layer. They are on the higher parts of the landscape. The clayey Sansarc and loamy Zahl soils are on the lower parts of the landscape.

Permeability is moderate in the Sully soil. Available water capacity is high. Organic matter content and fertility are low. Runoff is rapid.

Most areas support native grass and are used for grazing or hay. This soil has fair potential for rangeland. It has poor potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, most building sites, and most sanitary facilities.

The natural vegetation dominantly is little bluestem and lesser amounts of sideoats grama, green needlegrass, needleandthread, blue grama, and sedges. Overuse results in an increase in the extent of needleandthread, sideoats grama, and other short grasses. Continually overused rangeland is dominated by blue grama and sedges.

This soil generally is not suitable as cropland because of the thin, calcareous surface layer, the slope, and a severe hazard of erosion or soil blowing.

The choice of tame pasture plants is limited by low fertility, a high content of lime, and a severe erosion hazard. Suitable species for planting include intermediate

wheatgrass, pubescent wheatgrass, and smooth bromegrass.

This soil is not suited to windbreaks and environmental plantings. No species of trees and shrubs can grow well. Selected species of climatically adapted trees and shrubs can be established for special purposes, but optimum survival, growth, and vigor are unlikely.

This soil is too steep for most buildings and sanitary facilities. Capability unit VIe-3; Thin Upland range site.

21A—Linton-Grassna silt loams, 0 to 3 percent slopes. These deep, well drained and moderately well drained, nearly level soils are on uplands. Areas are irregular in shape and range from 5 to more than 700 acres in size. They are 40 to 50 percent Linton soil and 35 to 45 percent Grassna soil. The Linton soil is on the higher convex parts of the landscape. The Grassna soil is in swales and on the lower concave parts of the landscape. It is frequently flooded for very brief periods. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Linton soil has a surface layer of dark grayish brown silt loam about 7 inches thick. The subsoil is about 22 inches of friable silt loam. It is brown in the upper part and grayish brown and light brownish gray in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In places, this soil contains more clay.

Typically, the Grassna soil has a surface layer of very dark gray silt loam about 13 inches thick. The subsoil is about 17 inches of friable silt loam. It is dark brown in the upper part and grayish brown in the lower part. The underlying material to a depth of 60 inches is light brownish gray and light yellowish brown, calcareous silt loam.

Included with these soils in mapping are small areas of Sutley and Tonka soils. These included soils make up less than 25 percent of any one mapped area. The Sutley soils have lime at or near the surface. They are on the tops of low rises. The Tonka soils are in closed depressions less than 5 acres in size and are poorly drained.

Permeability is moderate in the Linton and Grassna soils. Available water capacity is high. The Linton soil is moderate in organic matter content and medium in fertility. The Grassna soil is high in organic matter content and in fertility. It has a moderate shrink-swell potential. It has a water table at a depth of 4 to 6 feet during wet periods. Runoff is slow on both soils.

Most areas are farmed. Some areas support native grass and are used for grazing or hay. These soils are well suited to irrigation. They have good potential for cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings. The Grassna soil has poor potential and the Linton soil good potential for most building sites and sanitary facilities.

These soils are well suited to all of the cultivated crops commonly grown in the county. They also are well suited to alfalfa, intermediate wheatgrass, and smooth bromegrass for tame pasture and hay. The main concerns of management are conserving moisture and maintaining fertility. Crop residue management and stubble mulching help conserve moisture and maintain fertility.

These soils are well suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs can grow well. Competing vegetation hinders the survival and growth of plantings. It can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

These soils are well suited to rangeland. The native vegetation on the Linton soil is bluestems, western wheatgrass, and green needlegrass. That on the Grassna soil is big bluestem and lesser amounts of switchgrass. Overused areas are dominated by western wheatgrass, needleandthread, and Kentucky bluegrass.

The Linton soil is suitable as a site for buildings and septic tank absorption fields, but the Grassna soil is poorly suited because it is subject to flooding. Linton soil in capability unit IIc-2, Silty range site; Grassna soil in capability unit IIc-3, Overflow range site.

21B—Linton silt loam, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands and terraces. It is in irregularly shaped areas that range from 5 to 350 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is about 22 inches of friable silt loam. It is brown in the upper part and grayish brown and light brownish gray in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In places, this soil contains more clay.

Included with this soil in mapping are small areas of Grassna, Sully, Sutley, and Tonka soils. These soils make up less than 15 percent of any one mapped area. The Grassna soils are in swales and on the lower parts of the landscape and are moderately well drained. Lime is at or near the surface of the Sully and Sutley soils. These soils are on the upper sides and tops of rises. The Tonka soils are in closed depressions less than 5 acres in size and are poorly drained.

Permeability is moderate in the Linton soil. Available water capacity is high. This soil is moderate in organic matter content and medium in fertility. Runoff is medium.

Most areas are farmed. A few areas support native grass and are used for grazing or hay. This soil is well suited to irrigation. It has good potential for cultivated crops, tame pasture and hay, rangeland, windbreaks and environmental plantings, most building sites, and most sanitary facilities.

This soil is well suited to small grain, corn, alfalfa, and other crops. The main concerns of management are controlling erosion and soil blowing and maintaining fer-

tility. Stubble mulching, crop residue management, field windbreaks, and stripcropping conserve moisture and help to maintain fertility and control erosion and soil blowing.

Using this soil as tame pasture and hayland is an effective way to control erosion. Suitable species for planting include alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass.

This soil is well suited to rangeland. The native vegetation is bluestems, western wheatgrass, and green needlegrass. Overused areas are dominated by western wheatgrass, needleandthread, and blue grama.

This soil is well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs grow well if competing vegetation is controlled. Fallowing a year before the trees or shrubs are planted, cultivating, and applying herbicides control plant competition.

This soil is well suited to building site development and most sanitary facilities. Capability unit IIe-1; Silty range site.

21C—Linton-Sutley silt loams, 6 to 9 percent slopes. These deep, well drained, moderately sloping soils are on uplands. Areas are irregular in shape and range from 5 to 150 acres in size. They are 50 to 60 percent Linton soil and about 30 to 40 percent Sutley soil. The Linton soil is on the lower and middle parts of the landscape. The Sutley soil is on the higher convex parts of the landscape. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Linton soil has a surface layer of dark grayish brown silt loam about 7 inches thick. The subsoil is about 22 inches of friable silt loam. It is brown in the upper part and grayish brown and light brownish gray in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In places, this soil contains more clay.

Typically, the Sutley soil has a surface layer of brown silt loam about 6 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In places, the surface layer has a lighter color.

Included with these soils in mapping are small areas of Grassna soils. These included soils make up less than 20 percent of any one mapped area. They are in swales and on the lower parts of the landscape and are moderately well drained.

Permeability is moderate in the Linton and Sutley soils. Available water capacity is high. The Linton soil is moderate in organic matter content and is medium in fertility. The Sutley soil is low in organic matter content and in fertility. Runoff is medium on both soils.

Most areas are farmed. Some areas support native grass and are used for grazing or hay. The Linton soil has good potential and the Sutley soil fair potential for cultivated crops, tame pasture and hay, and rangeland. The Linton soil has good potential and the Sutley soil poor potential for windbreaks and environmental plantings. Both soils have good potential for most building sites and most sanitary facilities.

The Linton soil is well suited to small grain, corn, alfalfa, and other crops. The main concern of management is controlling erosion and soil blowing. The lime in the Sutley soil adversely affects the availability of plant nutrients. Crop residue management, stubble mulching, and stripcropping help control erosion and soil blowing, conserve moisture, and maintain fertility. Grassed waterways help to keep gullies from forming.

These soils are suited to alfalfa, intermediate wheatgrass, pubescent wheatgrass, and smooth bromegrass for tame pasture and hay. On the Sutley soil, however, the growth of these plants is limited by low fertility, a high content of lime, and erosion.

In the areas of Linton soil used as rangeland, the natural vegetation is bluestems, western wheatgrass, and green needlegrass. Overused areas are dominated by western wheatgrass, needleandthread, and blue grama. The Sutley soil has a natural plant cover of little bluestem, sideoats grama, green needlegrass, and needleandthread. Overused areas are dominated by needleandthread, sideoats grama, and blue grama.

The Linton soil is well suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs can grow well. The Sutley soil is poorly suited to windbreaks. No species of trees and shrubs can grow well. Selected species of climatically adapted trees and shrubs can be established for special purposes, but optimum survival, growth, and vigor are unlikely. Fallowing a year before the trees or shrubs are planted, cultivating, and applying herbicides control competing vegetation and thus enhance the survival and growth of plantings. If possible, trees and shrubs should be planted on the contour to help control erosion.

These soils are suitable as sites for buildings and most sanitary facilities. Some land shaping may be necessary on building sites in the more sloping areas. Capability unit IIIe-1; Linton soil in Silty range site, Sutley soil in Thin Upland range site.

21D—Sully-Zahl complex, 9 to 40 percent slopes. These deep, well drained, strongly sloping to steep soils are on upland ridges. Areas are long and narrow or irregularly shaped and range from 5 to 300 acres in size. They are 40 to 50 percent Sully soil and 35 to 45 percent Zahl soil. The Sully soil is on the upper convex sides and tops of ridges and escarpments. The Zahl soil is on the middle and lower parts of the landscape. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Sully soil has a surface layer of grayish brown, calcareous silt loam about 3 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam over light brownish

gray very fine sandy loam. In some areas, the surface layer is darker colored.

Typically, the Zahl soil has a surface layer of dark grayish brown loam about 5 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous loam over light brownish gray, calcareous clay loam. In some areas, the depth to lime is greater and the content of clay is higher in the upper 10 inches.

Included with these soils in mapping are small areas of Linton, Opal, Sansarc, and Wabek soils. These included soils make up less than 25 percent of any one mapped area. The Linton soils do not have lime in the upper part. They are on the upper parts of the landscape. The areas of clayey Opal and Sansarc soils are intermingled with areas of the Zahl soil in small pockets and strips on the lower parts of the landscape. The Wabek soils contain gravel at a depth of 10 inches or less. They are in small pockets and strips on knolls and ridgetops.

Permeability is moderate in the Sully soil and in the upper part of the Zahl soil. It is moderately slow in the underlying material of the Zahl soil. Available water capacity is high in both soils. Organic matter content and fertility are low. Runoff is rapid.

Most areas support native grass and are used for grazing. These soils have fair potential for rangeland. They have poor potential for cultivated crops, windbreaks and environmental plantings, tame pasture and hay, building sites, and sanitary facilities.

The natural vegetation dominantly is little bluestems and lesser amounts of sideoats grama, green needlegrass, needleandthread, blue grama, and sedges. Overuse results in an increase in the extent of sideoats grama and other short grasses. Continually overused rangeland is dominated by blue grama and sedges.

These soils generally are unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the slope and a severe hazard of erosion or soil blowing.

These soils generally are too steep for buildings and sanitary facilities. Capability unit VIe-3; Thin Upland range site.

22B—Linton-Sutley silt loams, 2 to 6 percent slopes. These deep, well drained, very gently sloping and gently undulating soils are on uplands. They are in irregularly shaped areas that range from 5 to 120 acres in size. Slopes are smooth and convex. Individual areas are 50 to 60 percent Linton soil and 25 to 35 percent Sutley soil. The Linton soil is on the middle and lower parts of the landscape. The Sutley soil is on the higher parts of the landscape and the tops of low rises. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Linton soil has a surface layer of dark grayish brown silt loam about 7 inches thick. The subsoil is about 22 inches of friable silt loam. It is brown in the upper part and grayish brown and light brownish gray in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In places, the soil contains more clay.

Typically, the Sutley soil has a surface layer of brown silt loam about 6 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In places, the surface layer has a lighter color.

Included with these soils in mapping are small areas of Grassna, Vida, and Williams soils. These included soils make up less than 25 percent of any one mapped area. The Grassna soils are on the lower parts of the landscape and in swales and are moderately well drained. The Vida and Williams soils are not so silty as the Linton and Sutley soils. They occur as areas intermingled with some areas of those soils.

Permeability is moderate in the Linton and Sutley soils. Available water capacity is high. The Linton soil is moderate in organic matter content and medium in fertility. The Sutley soil is low in organic matter content and in fertility. Runoff is medium on both soils.

Most areas are farmed. A few areas support native grass and are used for grazing or hay. These soils are suited to irrigation. They have good potential for cultivated crops, windbreaks and environmental plantings, tame pasture and hay, rangeland, most building sites, and most sanitary facilities.

These soils are well suited to all of the crops commonly grown in the county and to alfalfa, intermediate wheatgrass, crested wheatgrass, and smooth bromegrass for tame pasture and hay. The main concerns of management are conserving moisture and controlling erosion and soil blowing. The lime in the surface layer of the Sutley soil adversely affects the availability of plant nutrients. Crop residue management, stubble mulching, stripcropping, and grassed waterways help control erosion and soil blowing, conserve moisture, and maintain fertility.

In the areas of Linton soil used as rangeland, the natural vegetation is bluestems, western wheatgrass, and green needlegrass. Overused areas are dominated by western wheatgrass, needleandthread, and blue grama. The Sutley soil has a natural plant cover of little bluestem, sideoats grama, green needlegrass, and needleandthread. Overused areas are dominated by needleandthread, sideoats grama, and blue grama.

The Linton soil is well suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs can grow well if competing vegetation is controlled. Fallowing a year before the trees or shrubs are planted, cultivating, and applying herbicides control plant competition. The Sutley soil is poorly suited to windbreaks and environmental plantings. No species of trees and shrubs grows well on this soil. Species of climatically adapted trees and shrubs can be established for special purposes, but optimum survival, growth, and vigor are unlikely.

These soils are well suited to building site development and sanitary facilities. Capability unit IIe-1; Linton soil in Silty range site, Sutley soil in Thin Upland range site.

22C—Linton silt loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on uplands. Individual areas are irregular in shape and range from 5 to 100 acres in size. Slopes are smooth and convex.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is about 22 inches of friable silt loam. It is brown in the upper part and is grayish brown and light brownish gray in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In places, this soil contains more clay.

Included with this soil in mapping are small areas of Grassna, Sully, and Sutley soils. These soils make up less than 15 percent of any one mapped area. The Grassna soils are in swales and are moderately well drained. The Sutley and Sully soils are on the upper parts of the landscape. Lime is at or near the surface of these soils.

Permeability is moderate in the Linton soil. Available water capacity is high. This soil is moderate in organic matter content and medium in fertility. Runoff is medium.

Many areas are farmed. A few areas support native grass and are used for grazing or hay. This soil has good potential for cultivated crops, tame pasture and hay, rangeland, windbreaks and environmental plantings, building sites, and most sanitary facilities.

This soil is well suited to small grain, corn, and alfalfa. The main concern of management is controlling erosion and soil blowing. Crop residue management, stubble mulching, contour farming, and grassed waterways help control erosion and soil blowing, conserve moisture, and maintain fertility.

Using this soil for tame pasture or hay is an effective way of controlling soil blowing. Suitable species for planting include alfalfa, intermediate wheatgrass, and smooth bromegrass.

This soil is well suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs can grow well if competing vegetation is controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides. Planting on the contour helps control erosion.

This soil is well suited to rangeland. The native vegetation is bluestems, western wheatgrass, and green needlegrass. Overused areas are dominated by western wheatgrass, needleandthread, and blue grama.

This soil is well suited to building site development and sanitary facilities. Land shaping may be necessary in the more sloping areas. Capability unit IIIe-1; Silty range site.

24A—Yecross loamy sand, 0 to 6 percent slopes. This deep, excessively drained, nearly level and gently undulating soil is on uplands. Areas are irregular in shape and range from 10 to more than 1,200 acres in size. Slopes are smooth and convex.

Typically, the surface layer is dark gray loamy sand about 8 inches thick. The underlying material to a depth of 60 inches is brown, calcareous sand over grayish brown gravelly sand. In places, the surface layer is thicker.

Included with this soil in mapping are small areas of Hecla, Lehr, and Wyndmere soils. These soils make up less than 15 percent of any one mapped area. The Hecla and Wyndmere soils are on the lower parts of the landscape and are not so well drained as the Yecross soil. The somewhat excessively drained Lehr soils are not so sandy as the Yecross soil. They occur as areas intermingled with some areas of that soil.

Permeability is rapid in the Yecross soil. Available water capacity is low. Organic matter content is moderate or low, and fertility is low. Runoff is slow, and most of the rainfall soaks into the soil.

Most areas support native grass and are used for grazing or hay. Some areas are farmed. This soil has good potential for rangeland, windbreaks and environmental plantings, tame pasture and hay, and most building sites. It has fair potential for cultivated crops and poor potential for most sanitary facilities.

The natural vegetation is dominantly sand bluestem, little bluestem, and prairie sandreed. Switchgrass and sand dropseed are less extensive. On overused rangeland, the bluestems decrease in extent and are replaced by prairie sandreed. On continually overused rangeland, bare areas are common and soil blowing is a serious problem.

Because of a severe soil blowing hazard, this soil is better suited to close sown crops than to row crops. Using the soil for tame pasture or hay is an effective way of controlling soil blowing. Crop residue management, stubble mulching, stripcropping, and field windbreaks help control soil blowing, maintain fertility, and conserve moisture.

This soil is well suited to windbreaks and environmental plantings. Except for those species that require an abundant supply of moisture, most of the climatically adapted trees and shrubs can grow well. Competing vegetation hinders the survival and growth of plantings. It can be controlled by cultivation and applications of herbicide (fig. 4). Keeping crop residue on the surface helps control soil blowing.

This soil is well suited to building site development. The effluent from all sanitary facilities can pollute shallow ground water. Capability unit IVe-9; Sands range site.

24C—Yecross loamy sand, 6 to 15 percent slopes. This deep, excessively drained, moderately sloping and strongly sloping soil is on uplands. Areas are irregular in shape and range from 10 to 100 acres in size. Slopes are smooth and convex.

Typically, the surface layer is dark gray loamy sand about 6 inches thick. The underlying material to a depth

Figure 4.—Trees and shrubs planted in an area of Yecross loamy sand, 0 to 6 percent slopes. Clean cultivation results in good survival and growth rates.

of 60 inches is brown, calcareous sand and gravelly sand. In places, the surface layer is thicker. In some areas, it contains more clay.

Included with this soil in mapping are small areas of Parshall, Tally, and Vida soils. These soils make up less than 15 percent of any one mapped area. The well drained Parshall soils are on the lower parts of the landscape. The Tally soils contain more clay than the Yecross soil. They occur as areas intermingled with some areas of that soil. The Vida soils formed in glacial till. They are on the middle parts of the landscape.

Permeability is rapid in the Yecross soil. Available water capacity is low. Organic matter content and fertility also are low. Runoff is slow, and most of the rainfall soaks into the soil.

Most areas support native grass. This soil has good potential for rangeland and fair potential for windbreaks and environmental plantings and most building sites. As a result of severe hazards of erosion and soil blowing, it has poor potential for cultivated crops and tame pasture and hay. The potential also is poor for most sanitary facilities.

The natural vegetation is dominantly sand bluestem, little bluestem, and prairie sandreed. Switchgrass and sand dropseed are less extensive. On overused rangeland, the bluestems decrease in extent and are replaced by prairie sandreed. On continually overused rangeland, bare areas are common and soil blowing is a serious problem.

This soil is suited to windbreaks and environmental plantings only if evergreens are selected. Planting trees in sod without prior site preparation helps control soil blowing.

This soil is suitable as a site for most buildings and septic tank absorption fields. Considerable land shaping is necessary, however, in the more sloping areas. The

effluent from all sanitary facilities can pollute shallow ground water. Capability unit VIe-7; Sands range site.

27B—Maddock loamy fine sand, 0 to 6 percent slopes. This deep, well drained, nearly level and gently undulating soil is on uplands. Areas are irregular in shape and range from 5 to more than 700 acres in size. Slopes are smooth and convex.

Typically, the surface layer is very dark gray loamy fine sand about 15 inches thick. The subsoil is about 13 inches of dark grayish brown, loose fine sand. The underlying material to a depth of 60 inches is brown fine sand over grayish brown loamy fine sand. In places, the surface layer is thinner.

Included with this soil in mapping are small areas of Hecla, Tally, and Wyndmere soils. These soils make up less than 10 percent of any one mapped area. The Hecla soils are moderately well drained and are on the lower parts of the landscape and in swales. The Tally and Wyndmere soils contain more clay than the Maddock soil. They occur as areas intermingled with some areas of that soil.

Permeability is rapid in the Maddock soil. Available water capacity is low. This soil is moderate in organic matter content and is medium in fertility. Runoff is slow, and most of the water soaks in the soil.

Most areas are farmed. Some areas are used for grazing or hay. This soil has good potential for rangeland, windbreaks and environmental plantings, tame pasture and hay, and most building sites. It has fair potential for cultivated crops and poor potential for most sanitary facilities.

This soil is better suited to close sown crops than to row crops. The main concern in managing cultivated areas is controlling soil blowing. Conservation of moisture also is a concern. Crop residue management, stubble mulching, stripcropping, and field windbreaks help control soil blowing and conserve moisture.

Using this soil as tame pasture or hayland is an effective way of controlling soil blowing. Suitable species include alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. A mulch of crop residue helps control erosion until the pasture plants are established.

The natural vegetation is dominantly sand bluestem, little bluestem, and prairie sandreed. Switchgrass and sand dropseed are less extensive. On overused rangeland, the bluestems decrease in extent and are replaced by prairie sandreed. On continually overused rangeland, bare areas are common and soil blowing is a serious problem.

This soil is well suited to windbreaks and environmental plantings. Except for those species that require an abundant supply of moisture, most of the climatically adapted trees and shrubs can grow well. Competing vegetation hinders the survival and growth of plantings. It can be controlled by fallowing a year prior to planting. Keeping crop residue on the surface helps control soil blowing.

This soil is suitable as a site for buildings and septic tank absorption fields. The effluent from all sanitary facilities can pollute shallow ground water. Capability unit IVe-9; Sands range site.

27C—Maddock loamy fine sand, 6 to 12 percent slopes. This deep, well drained, moderately sloping and strongly sloping soil is on uplands. Areas are irregular in shape and range from 5 to 150 acres in size.

Typically, the surface layer is very dark gray loamy fine sand about 15 inches thick. The subsoil is about 13 inches of dark grayish brown, loose fine sand. The underlying material to a depth of 60 inches is brown fine sand over grayish brown loamy fine sand. In places, the surface layer is thinner.

Included with this soil in mapping are small areas of Hecla and Tally soils. These soils make up less than 15 percent of any one mapped area. The Hecla soils are moderately well drained and are on the lower parts of the landscape. The Tally soils contain more clay than the Maddock soil. They occur as areas intermingled with some areas of that soil.

Permeability is rapid in the Maddock soil. Available water capacity is low. This soil is moderate in organic matter content and is medium in fertility. Runoff is slow, and most of the water soaks in the soil.

Most large areas support native grass and are used for grazing or hay. Many small areas are farmed with adjacent soils. This soil has good potential for rangeland and tame pasture and hay and fair potential for most building sites. It has poor potential for cultivated crops because the hazard of soil blowing is severe. The potential also is poor for windbreaks and environmental plantings and most sanitary facilities.

The natural vegetation is dominantly sand bluestem, little bluestem, and prairie sandreed. Switchgrass and sand dropseed are less extensive. On overused rangeland, the bluestems decrease in extent and are replaced by prairie sandreed. On continually overused rangeland, bare areas are common and soil blowing is a serious problem.

Using this soil as pasture or hayland is an effective way of controlling soil blowing. Suitable species for planting include alfalfa, intermediate wheatgrass, and smooth bromegrass. A mulch of crop residue helps control soil blowing until the pasture plants are established.

This soil generally is unsuited to windbreaks and environmental plantings. Species selected for planting should be limited to evergreens. Planting trees without prior site preparation helps control soil blowing.

Land shaping is necessary in the more sloping areas if this soil is used as a building site. The effluent from all sanitary facilities can pollute shallow ground water. Capability unit VIe-7; Sands range site.

28—Wyndmere fine sandy loam, 0 to 3 percent slopes. This deep, somewhat poorly drained, nearly level soil is on terraces. Areas are long and narrow or irregularly shaped and range from 5 to 90 acres in size. Slopes are smooth and slightly concave.

Typically, the surface layer is calcareous fine sandy loam about 13 inches thick. It is very dark gray in the upper part and dark gray in the lower part. The underlying material to a depth of 60 inches is light brownish gray and grayish brown, calcareous fine sandy loam and loamy fine sand.

Included with this soil in mapping are small areas of Arveson, Maddock, Tally, and Yecross soils. These soils make up less than 10 percent of any one mapped area. The Arveson soils are on the lower parts of the landscape and are poorly drained. The Maddock, Tally, and Yecross soils are on the tops of low rises or occur as areas intermingled with areas of the Wyndmere soil. They are better drained than that soil.

Permeability is moderately rapid in the Wyndmere soil. Available water capacity is low. Organic matter content is moderate, and fertility is medium. The surface layer contains lime. The water table rises to within 2 to 5 feet of the surface during wet years. Runoff is slow.

Most areas are farmed. Some areas support native grass and are used for grazing or hay. This soil has good potential for cultivated crops, rangeland, tame pasture and hay, and windbreaks and environmental plantings. It has poor potential for most building sites and sanitary facilities.

This soil is suited to all of the crops commonly grown in the county. It also is suited to alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass for tame pasture and hay. The main concerns of management are controlling soil blowing and conserving moisture. The lime in the surface layer adversely affects the availability of plant nutrients, results in susceptibility to soil blowing, and in dry years results in earlier maturing of crops. Because of this early maturing, small grain is better suited than other crops. Crop residue management, stubble mulching, stripcropping, and field windbreaks help control soil blowing, conserve moisture, and maintain fertility.

This soil is well suited to rangeland. The natural plant cover dominantly is bluestems and prairie sandreed. Needleandthread, blue grama, and western wheatgrass are less extensive. Overused areas are dominated by prairie sandreed, needleandthread, blue grama, and Kentucky bluegrass.

This soil is well suited to all of the climatically adapted trees and shrubs. It has a moisture regime that favors the survival of trees and shrubs requiring additional moisture. Competing vegetation hinders the survival and growth of plantings. It can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

Because it is wet, this soil is poorly suited to building site development and sanitary facilities. Capability unit IIIe-7; Sandy range site.

29—Vallers loam. This deep, poorly drained, nearly level soil is on flood plains and in drainageways. It is subject to rare flooding. Areas are long and narrow or irregularly shaped and range from 5 to 70 acres in size. Slopes are long and slightly concave.

Typically, the surface layer is about 9 inches of calcareous loam. It is very dark gray in the upper part and dark grayish brown in the lower part. The next 4 inches is white, friable, calcareous clay loam. Below this to a depth of 60 inches is light gray, light olive gray, and gray, mottled, calcareous clay loam.

Included with this soil in mapping are small areas of Divide, Parnell, and Regan soils. These soils make up less than 15 percent of any one mapped area. The Divide soils are on slight rises. They are underlain by sand and gravel. The Parnell soils are in closed depressions less than 5 acres in size. The Regan soils are on the slightly lower parts of the landscape. Parnell and Regan soils are very poorly drained.

Permeability is moderately slow in the Vallers soil. Available water capacity is high. This soil is moderate in organic matter content and is medium in fertility. The surface layer contains lime. The water table rises to within 1 to 2.5 feet of the surface during wet years. Runoff is slow.

Most areas support native grass and are used for grazing or hay. This soil has good potential for rangeland, windbreaks and environmental plantings, and tame pasture and hay and fair potential for cultivated crops. It has poor potential for building sites and sanitary facilities.

If this soil is used as rangeland, the tall prairie grasses are highly productive because they benefit from the high water table. The natural vegetation is big bluestem, switchgrass, indiangrass, and prairie cordgrass. In overused areas, the natural grasses lose vigor and are replaced by inland saltgrass, Kentucky bluegrass, and western wheatgrass.

This soil is suitable as cropland. Wetness may delay tillage in the spring and in other periods during wet years. Artificial drainage generally is not feasible. The high content of lime in the surface layer adversely affects the availability of plant nutrients.

The choice of tame pasture plants is limited mainly to water tolerant species. Suitable species for planting include Garrison creeping foxtail and reed canarygrass.

This soil is suited to windbreaks and environmental plantings if it is adequately drained. Climatically adapted trees and shrubs grow well because of the abundant supply of moisture.

This soil is poorly suited to building site development and sanitary facilities because of wetness and flooding. Capability unit IVw-1; Subirrigated range site.

30—Parnell silty clay loam, ponded. This deep, very poorly drained, level soil is in closed depressions and along the edges of lakes. In most years it is covered by water that is seldom more than 2 feet deep during the growing season. Areas are circular or long and narrow and range from 5 to 200 acres in size.

Typically, the surface layer is dark gray silty clay loam about 16 inches thick. The subsoil is about 32 inches of firm silty clay. It is gray in the upper part and dark gray in the lower part. The underlying material to a depth of 60 inches is gray silty clay. In places, this soil contains less clay and has lime within a depth of 16 inches.

Included with this soil in mapping are small areas of Egas, Heil, and Tonka soils. These soils make up less than 10 percent of any one mapped area. The poorly drained Egas soils contain salts. They occur as areas intermingled with most areas of the Parnell soil. The Heil and Tonka soils are mainly along the outer edges of the depressions. They are poorly drained.

Permeability is slow in the Parnell soil. Available water capacity is high. This soil is moderate in organic matter content and medium in fertility. As much as 2 feet of water accumulates on the surface during wet periods. During some dry periods, the water table is as deep as 1 foot.

Most areas are used as habitat for wetland wildlife. Deer, pheasants, and other wildlife frequent the margins of these areas. The native vegetation is such plants as cattails, rushes, and sedges. The vegetated areas commonly are interspersed with small bodies of water. Because it is wet, this soil has good potential for wetland wildlife habitat and poor potential for rangeland. It is too wet for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings.

This soil generally is unsuitable as a site for buildings and sanitary facilities because it is ponded in most years. Capability unit VIIIw-1; not assigned to a range site.

31E—Lihen loamy fine sand, 9 to 20 percent slopes. This deep, well drained, strongly sloping and hilly soil is on uplands. It is in irregularly shaped areas that range from 10 to 225 acres in size. Slopes are short and convex.

Typically, the surface layer is brown loamy fine sand about 15 inches thick. The next 5 inches is brown, calcareous loamy fine sand. The underlying material to a depth of 60 inches is brown, calcareous loamy fine sand over light olive brown, calcareous fine sandy loam. In places, soft sandstone is within a depth of 40 inches.

Included with this soil in mapping are small areas of Opal, Sansarc, and Sully soils. These soils make up less than 15 percent of any one mapped area. The clayey, moderately deep Opal and clayey, shallow Sansarc soils are on the lower parts of the landscape. The silty Sully soils are on the upper sides and tops of knolls and ridges.

Permeability is rapid in the Lihen soil. Available water capacity is moderate. This soil is low in organic matter content and in fertility. Runoff is slow.

Most large areas support native grass and are used for grazing. This soil has good potential for rangeland. It has poor potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, sanitary facilities, and most building sites because it is strongly sloping and hilly.

The natural vegetation is dominantly sand bluestem, little bluestem, and prairie sandreed. Switchgrass and sand dropseed are less extensive. On overused rangeland, the bluestems decrease in extent and are replaced by prairie sandreed. On continually overused rangeland, bare areas are common and soil blowing is a serious problem.

If buildings and septic tank absorption fields are constructed on this soil, considerable land shaping is necessary. The effluent from all sanitary facilities can pollute shallow ground water. Capability unit VIe-7; Sandy range site.

32F—Flasher loamy fine sand, 25 to 50 percent slopes. This shallow, somewhat excessively drained, steep and very steep soil is on uplands. It is in long and narrow or irregularly shaped areas that range from 10 to 200 acres in size. Slopes are short and convex.

Typically, the surface layer is dark grayish brown loamy fine sand about 5 inches thick. The underlying material, to a depth of 18 inches, is olive brown loamy fine sand over light yellowish brown fine sand. Soft sandstone is at a depth of 18 inches. In places, it is below a depth of 40 inches.

Included with this soil in mapping are small areas of Sansarc and Sully soils. These soils make up less than 10 percent of any one mapped area. The clayey Sansarc soils are on the lower parts of the landscape. The silty Sully soils are on the tops of ridges.

Permeability is rapid in the Flasher soil. Available water capacity is very low. This soil is low in organic matter content and in fertility. Runoff is medium.

Most areas support native grass and are used for grazing. This soil has fair potential for rangeland and poor potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, building sites, and sanitary facilities.

The native vegetation mainly is little bluestem and needleandthread. Sideoats grama and western wheatgrass are less extensive. Overuse results in a decrease in the extent of little bluestem and an increase in the extent of needleandthread and short grasses.

This soil is too steep and too shallow for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. As a result of those limitations, it is poorly suited to building site development and sanitary facilities. Capability unit VIIe-4; Shallow range site.

34A—Bowdle loam, 0 to 3 percent slopes. This well drained, nearly level soil is moderately deep over sand and gravel. It is on upland terraces. Areas are irregularly shaped and range from 5 to 700 acres in size. Slopes are smooth or concave.

Typically, the surface layer is very dark grayish brown loam about 6 inches thick. The subsoil is about 12 inches of friable loam. It is very dark grayish brown in the upper part and dark grayish brown in the lower part. The underlying material, to a depth of 25 inches, is grayish brown, calcareous loam. Below this to a depth of 60 inches is multicolored sand and gravel. In places, sand and gravel is within a depth of 20 inches and dark colors extend to a depth of less than 16 inches.

Included with this soil in mapping are small areas of Bowbells and Tonka soils. These soils make up less than 15 percent of any one mapped area. The Bowbells soils are in swales and narrow drainageways and are moderately well drained. The Tonka soils are in closed depressions less than 5 acres in size and are poorly drained.

Permeability is moderate in the subsoil of the Bowdle soil and rapid in the underlying sand and gravel. Available water capacity is low. This soil is high in organic matter content and in fertility. The porous underlying material limits root penetration. Runoff is slow.

Most areas are farmed. A few areas support native grass and are used for grazing or hay. This soil has good potential for tame pasture and hay, rangeland, and most building sites. It has fair potential for cultivated crops and windbreaks and environmental plantings and poor potential for most sanitary facilities.

This soil is suited to small grain, corn, alfalfa, and other crops. Conserving moisture is the main concern of management. The porous underlying sand and gravel limits root penetration and reduces the water storage capacity. As a result, early maturing small grain is better suited than crops that mature later. Crop residue management and stubble mulching conserve moisture.

This soil is suited to tame pasture and hay. Suitable species are crested wheatgrass, intermediate wheatgrass, and smooth bromegrass.

Windbreaks and environmental plantings can be established on this soil. Because of the shallow root zone and the low available water capacity, however, careful selection of trees and shrubs is needed. Optimum growth and survival rates are unlikely. Fallowing a year before the trees or shrubs are planted, cultivating, and applying herbicides control competing vegetation and thus enhance the survival and growth of plantings.

The native vegetation is bluestems, western wheatgrass, and green needlegrass. Overused rangeland is dominated by western wheatgrass, needleandthread, and blue grama.

This soil is well suited to building site development, but the sides of shallow excavations can cave in. The soil is well suited to septic tank absorption fields, but the effluent from all sanitary facilities can pollute shallow ground water. Capability unit IIIs-2; Silty range site.

34B—Bowdle loam, 3 to 6 percent slopes. This well drained, gently sloping soil is moderately deep over sand and gravel. It is on upland terraces. Areas are irregularly shaped and range from 5 to 300 acres in size. Slopes are long and convex.

Typically, the surface layer is very dark grayish brown loam about 6 inches thick. The subsoil is about 12 inches of friable loam. It is very dark grayish brown in the upper part and dark grayish brown in the lower part. The underlying material, to a depth of 25 inches, is grayish brown, calcareous loam. Below this to a depth of 60 inches is multicolored sand and gravel. In places, sand and gravel is within a depth of 20 inches and dark colors extend to a depth of less than 16 inches.

Included with this soil in mapping are small areas of Bowbells, Tonka, Wabek, and Williams soils. These soils make up less than 15 percent of any one mapped area. The Bowbells soils are on the lower parts of the landscape and in swales and are moderately well drained. The Wabek soils are not so deep to sand and gravel as the Bowdle soil. They are on the tops of low rises. The Williams soils formed in glacial till. They occur as areas intermingled with areas of the Bowdle soil. The Tonka soils are in closed depressions less than 5 acres in size and are poorly drained.

Permeability is moderate in the subsoil of the Bowdle soil and rapid in the underlying sand and gravel. Available water capacity is low. This soil is high in organic matter content and in fertility. The porous underlying material limits root penetration. Runoff is medium.

Most areas are farmed. A few areas support native grass and are used for grazing or hay. This soil has good potential for tame pasture and hay, rangeland, and most building sites. It has fair potential for cultivated crops and windbreaks and environmental plantings and poor potential for most sanitary facilities.

This soil is suited to small grain, corn, alfalfa, and other crops. It is well suited to irrigation. Controlling erosion and conserving moisture are the main concerns of management. The porous underlying material limits root penetration and reduces the water storage capacity. As a result, early maturing small grain is better suited than crops that mature later. Stubble mulching and crop residue management conserve moisture and help to control erosion.

Using this soil as tame pasture and hayland is an effective way of controlling erosion. Suitable species include alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass.

Windbreaks and environmental plantings can be established on this soil. Because of the shallow root zone and the low available water capacity, however, careful selection of trees and shrubs is needed. Optimum growth and survival rates are unlikely. Fallowing a year before the

trees or shrubs are planted, cultivating, and applying herbicides control competing vegetation and thus enhance the survival and growth of plantings.

The native vegetation is bluestems, western wheatgrass, and green needlegrass. Overused rangeland is dominated by western wheatgrass, needleandthread, and blue grama.

This soil is suited to building site development, but the sides of shallow excavations can cave in. Some land leveling is necessary if the more sloping areas are used as sites for small commercial buildings. The soil is well suited to septic tank absorption fields, but the effluent from all sanitary facilities can pollute shallow ground water. Capability unit IIIe-6; Silty range site.

36B—Lehr-Wabek loams, 2 to 6 percent slopes. These somewhat excessively and excessively drained, gently undulating soils are shallow and very shallow over sand and gravel. They are on upland terraces. Areas are irregularly shaped or long and narrow and range from 5 to 200 acres in size. They are 50 to 60 percent Lehr soil and 30 to 40 percent Wabek soil. The Lehr soil is on the middle and lower concave parts of the landscape. The Wabek soil is on the upper convex parts of the landscape (fig. 5). The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Lehr soil has a surface layer of dark grayish brown loam about 5 inches thick. The subsoil is about 12 inches of very friable loam. It is dark grayish brown in the upper part and grayish brown and calcareous in the lower part. The underlying material to a depth of 60 inches is multicolored, calcareous sand and gravel. In places, this soil has sand and gravel below a depth of 20 inches.

Typically, the Wabek soil has a surface layer of dark grayish brown loam about 6 inches thick. The underlying material to a depth of 10 inches is dark grayish brown, calcareous gravelly loam. Below this to a depth of 60 inches is multicolored, calcareous sand and gravel. In places, this soil is calcareous at or near the surface.

Included with these soils in mapping are small areas of Bowbells, Tonka, and Williams soils. These included

Figure 5.—An area of Lehr-Wabek loams, 2 to 6 percent slopes. The Lehr soil is on the lower parts of the landscape, and the Wabek soil is on the convex parts.

soils make up less than 20 percent of any one mapped area. The Bowbells soils are moderately well drained and are in swales. The Tonka soils are in closed depressions less than 5 acres in size and are poorly drained. The Williams soils formed in glacial till. They are on the lower parts of the landscape.

Permeability is moderately rapid in the subsoil of the Lehr soil and rapid in the underlying sand and gravel. It is rapid in the Wabek soil. Available water capacity is low in both soils. The Lehr soil is moderate in organic matter content and medium in fertility. The Wabek soil is moderate or low in organic matter content and low in fertility. Runoff is slow on both soils.

Many areas are farmed. Some areas are used for grazing or hay. These soils have fair potential for cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings. They have good potential for most building sites and poor potential for most sanitary facilities.

The Lehr soil is best suited to early maturing small grain. The Wabek soil generally is unsuited to cultivated crops because it is shallow to gravel, is excessively drained, and has a low available water capacity. Stubble mulching and crop residue management conserve moisture, help to control erosion, and maintain fertility.

On the Lehr soil, the choice of tame pasture plants is limited by the low available water capacity in most years and by a shallow root zone. Crested wheatgrass is suitable on this soil. No pasture plants can grow well on the Wabek soil.

Windbreaks and environmental plantings can be established on the Lehr soil only if suitable trees and shrubs are selected. This soil is droughty and has a shallow root zone. As a result, optimum survival and growth rates are unlikely. The Wabek soil is not suited to windbreaks or environmental plantings.

The Lehr and Wabek soils are suitable as building sites, but the sides of shallow excavations can cave in. These soils are suited to septic tank absorption fields, but the effluent from all sanitary facilities can pollute shallow ground water. Lehr soil in capability unit IVe-6, Shallow to Gravel range site; Wabek soil in capability unit VIs-4, Very Shallow range site.

38—Parnell silty clay loam. This deep, very poorly drained, level soil is in closed depressions. It is frequently flooded for long periods. Areas are irregular in shape and range from 5 to 75 acres in size. Slopes are smooth.

Typically, the surface layer is dark gray silty clay loam about 16 inches thick. The subsoil is about 32 inches of firm silty clay. It is gray in the upper part and dark gray in the lower part. The underlying material to a depth of 60 inches is gray silty clay. In places, this soil contains less clay and has lime within a depth of 16 inches.

Included with this soil in mapping are small areas of the moderately well drained Bowbells, poorly drained Heil and Tonka, and well drained Williams soils. These soils make up less than 10 percent of any one mapped area. They are along the outer edges of the larger depressions.

Permeability is slow in the Parnell soil. Available water capacity is high. This soil is high in organic matter content and in fertility. The subsoil has a high shrink-swell potential. The water table is near the surface or 1 foot above the surface in the spring and in most years is within a depth of 2 feet throughout much of the growing season. The soil is ponded during wet periods.

Most large areas support native grass. Some small areas are farmed with adjacent soils. This soil has fair potential for rangeland and tame pasture and hay. It has poor potential for cultivated crops, windbreaks and environmental plantings, building sites, and most sanitary facilities.

The natural vegetation mainly is prairie cordgrass, reedgrass, and sedges. Overuse results in an increase in the extent of Kentucky bluegrass, saltgrass, sedges, and rushes. This soil provides good sites for stock water dugouts.

This soil is too wet and too frequently flooded for cultivated crops or for windbreaks and environmental plantings. It usually is ponded or has a water table at or near the surface during the growing season.

Because this soil is very poorly drained and cannot be artificially drained, the choice of tame pasture plants is limited to water tolerant species. Suitable species for planting include Garrison creeping foxtail and reed canarygrass.

This soil is poorly suited to building site development and most sanitary facilities because of flooding and wetness. Capability unit Vw-4; Wetland range site.

39E—Sansarc-Opal clays, 15 to 40 percent slopes. These shallow and moderately deep, well drained, moderately steep and steep soils are on uplands. In some areas, scattered stones are on the surface, drainageways are entrenched, and shale is exposed on the steeper slopes. Areas are irregular in shape and range from 10 to more than 1,000 acres in size. They are 45 to 55 percent Sansarc soil and 35 to 45 percent Opal soil. The Sansarc soil is on the middle and upper convex parts of the landscape. The Opal soil has a slope of 15 to 25 percent and is on the lower and middle parts of the landscape. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Sansarc soil has a surface layer of grayish brown, calcareous clay about 4 inches thick. The underlying material to a depth of 11 inches is grayish brown, calcareous shaly clay. Below this to a depth of 60 inches is dark gray, soft shale.

Typically, the Opal soil has a surface layer of dark grayish brown clay about 5 inches thick. The subsoil is about 17 inches of very firm, calcareous clay. It is grayish brown in the upper part and light brownish gray in the

lower part. The next 9 inches is light brownish gray, calcareous clay and shaly clay. Below this to a depth of 60 inches is gray shale. In places, the shale is below a depth of 40 inches.

Included with these soils in mapping are small areas of Hurley, Sully, Wabek, and Zahl soils. These included soils make up less than 20 percent of any one mapped area. The moderately well drained Hurley soils are in swales and in small drainageways. They contain more salts in the subsoil than the Opal and Sansarc soils. Sully, Wabek, and Zahl soils are in small areas on the upper sides and tops of some of the sharp ridges and knolls. Sully soils are silty, Wabek soils are shallow to sand and gravel, and Zahl soils are loamy and formed in clay loam glacial till.

Permeability is slow in the Sansarc soil and very slow in the Opal soil. Available water capacity is very low in the Sansarc soil and low in the Opal soil. The Sansarc soil is low in organic matter content and in fertility. The Opal soil is moderate in organic matter content and medium in fertility. The shrink-swell potential is high in both soils. Runoff is very rapid.

Most areas support native grass and are used for grazing or hay. Some small areas of the included Wabek soil on ridges and the top of knolls are a source of sand and gravel. The Sansarc soil has fair potential and the Opal soil good potential for rangeland. Both soils have poor potential for cultivated crops, tame pasture and hay, building sites, sanitary facilities, and windbreaks and environmental plantings.

The natural vegetation on the Sansarc soil is western wheatgrass, green needlegrass, bluestems, and sideoats grama. That on the Opal soil dominantly is western wheatgrass, green needlegrass, and blue grama. Overuse results in an increase in the extent of western wheatgrass, blue grama, and buffalograss and a decrease in the extent of bluestems and green needlegrass. Sites for stock water ponds generally are available in the draws (fig. 6).

These soils generally are too steep for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. Soil loss would be excessive if cultivated crops were grown.

These soils generally are unsuitable as sites for buildings and sanitary facilities because they are moderately steep and steep and have a high shrink-swell potential. Capability unit VIIe-8; Sansarc soil in Shallow Clay range site, Opal soil in Clayey range site.

40B—Opal clay, 3 to 6 percent slopes. This moderately deep, well drained, gently sloping or undulating soil

Figure 6.—Livestock water development in an area of Sansarc-Opal clays, 15 to 40 percent slopes.

is on uplands. Areas are irregular in shape and range from 10 to 100 acres in size. Slopes are long and convex.

Typically, the surface layer is dark grayish brown clay about 5 inches thick. The subsoil is about 17 inches of very firm, calcareous clay. It is grayish brown in the upper part and light brownish gray in the lower part. The next 9 inches is light brownish gray, calcareous clay and shaly clay. Below this to a depth of 60 inches is gray shale. In places, the shale is below a depth of 40 inches.

Included with this soil in mapping are small areas of Hurley soils. These soils make up less than 10 percent of any one mapped area. They are on the lower parts of the landscape and in swales. They contain more salts in the subsoil than the Opal soil.

Permeability is very slow in the Opal soil. Available water capacity is low. This soil is moderate in organic matter content and is medium in fertility. The shrink-swell potential is high. Runoff is medium.

Most areas support native grass and are used for grazing and hay. Some areas are farmed. This soil has good potential for rangeland and fair potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has poor potential for building sites and most sanitary facilities.

The natural vegetation dominantly is western wheatgrass and green needlegrass and an understory of blue grama and buffalograss. Overuse results in an increase in the extent of western wheatgrass and short grasses.

If this soil is farmed, the main concerns of management are controlling erosion and soil blowing and improving tilth. Small grain and alfalfa are better suited than row crops because of the erosion hazard. Crop residue management, stubble mulching, and stripcropping help control erosion and soil blowing and improve or maintain tilth. Grassed waterways help to keep gullies from forming.

Using this soil for tame pasture and hay is effective in controlling erosion. Suitable species for planting include alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass.

This soil is suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs can grow well. The main concerns of management are the limited rainfall; the clayey subsoils, which retard root growth; and erosion. Fallowing a year before the trees or shrubs are planted, cultivating, and applying herbicides help control competing vegetation and thus enhance the survival and growth of plantings.

This soil is poorly suited to most kinds of building site development because it has a high shrink-swell potential. It is poorly suited to most sanitary facilities because of the moderate depth to bedrock and the restricted permeability. Lagoons and holding tanks are alternate waste disposal systems. Capability unit IIIe-4; Clayey range site.

40C—Opal clay, 6 to 9 percent slopes. This moderately deep, well drained, moderately sloping or gently rolling soil is on uplands. Areas are irregular in shape and range from 10 to 200 acres in size. Slopes are long and convex. A few scattered stones are on the surface in some areas.

Typically, the surface layer is dark grayish brown clay about 5 inches thick. The subsoil is about 17 inches of very firm, calcareous clay. It is grayish brown in the upper part and light brownish gray in the lower part. The next 9 inches is light brownish gray, calcareous clay and shaly clay. Below this to a depth of 60 inches is gray shale. In places, the shale is below a depth of 40 inches.

Included with this soil in mapping are small areas of Hurley and Sansarc soils. These soils make up less than 15 percent of any one mapped area. The Hurley soils are on the lower parts of the landscape and in swales. They contain more salts in the subsoil than the Opal soil. The shallow Sansarc soils are on the upper sides and tops of low ridges and knolls.

Permeability is very slow in the Opal soil. Available water capacity is low. This soil is moderate in organic matter content and is medium in fertility. The shrink-swell potential is high. Runoff is medium.

Most areas support native grass and are used for grazing or hay. Some are farmed. This soil has good potential for rangeland. It has fair potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has poor potential for building sites and most sanitary facilities.

The natural vegetation dominantly is western wheatgrass and green needlegrass and an understory of blue grama and buffalograss. Overuse results in an increase in the extent of western wheatgrass and short grasses.

If this soil is farmed, the main concerns of management are controlling erosion and soil blowing and improving tilth. Small grain and alfalfa are better suited than row crops because of the erosion hazard. Crop residue management, stubble mulching, and contour stripcropping help control erosion and soil blowing and improve or maintain tilth. Grassed waterways help to keep gullies from forming.

Using this soil for tame pasture and hay is effective in controlling erosion. Suitable species for planting include alfalfa, intermediate wheatgrass, and smooth bromegrass.

This soil is suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs can grow well. The main concerns of management are the limited rainfall; the clayey subsoil, which retards root growth; and erosion. If possible, the trees or shrubs should be planted on the contour to help control erosion. Fallowing a year before the trees or shrubs are planted, cultivating, and applying herbicides help control competing vegetation and thus enhance the survival and growth of plantings.

This soil is poorly suited to most kinds of building site development because it has a high shrink-swell potential. It is poorly suited to most sanitary facilities because of the moderate depth to bedrock and the restricted permeability. Lagoons and holding tanks are alternate waste disposal systems. Capability unit IVe-4; Clayey range site.

40D—Opal-Sansarc clays, 6 to 15 percent slopes. These moderately deep and shallow, well drained, moderately sloping or rolling soils are on uplands. In some areas, scattered stones are on the surface and drainageways are entrenched. Areas are irregular in shape and range from 5 to more than 1,000 acres in size. They are 50 to 60 percent Opal soil and 25 to 35 percent Sansarc soil. The Opal soil is on the lower and middle parts of the landscape. The Sansarc soil is on the upper convex sides and tops of ridges and hills. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Opal soil has a surface layer of dark grayish brown clay about 5 inches thick. The subsoil is about 17 inches of very firm, calcareous clay. It is grayish brown in the upper part and light brownish gray in the lower part. The next 9 inches is light brownish gray, calcareous clay and shaly clay. Below this to a depth of 60 inches is gray shale. In places, the shale is below a depth of 40 inches.

Typically, the Sansarc soil has a surface layer of grayish brown, calcareous clay about 4 inches thick. The underlying material to a depth of 11 inches is grayish brown, calcareous shaly clay. Below this to a depth of 60 inches is dark gray, soft shale.

Included with these soils in mapping are small areas of Hurley, Linton, Sully, and Zahl soils. These included soils make up less than 25 percent of any one mapped area. The Hurley soils are in swales. They contain more salts in the subsoil than the Opal and Sansarc soils. The Linton, Sully, and Zahl soils are on the higher parts of some of the sharp ridges and knolls. The Linton and Sully soils are silty, and the Zahl soils are loamy.

Permeability is very slow in the Opal soil and slow in the Sansarc soil. Available water capacity is low in the Opal soil and very low in the Sansarc soil. The Opal soil is moderate in organic matter content and medium in fertility. The Sansarc soil is low in organic matter content and in fertility. The shrink-swell potential is high in both soils. Runoff is rapid.

Most areas support native grass and are used for grazing or hay. The Opal soil has good potential and the Sansarc soil fair potential for rangeland. Both soils have poor potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, building sites, and most sanitary facilities.

The natural vegetation on the Opal soil dominantly is western wheatgrass, green needlegrass, and blue grama. That on the Sansarc soil is little bluestem, sideoats grama, green needlegrass, and western wheatgrass. Overuse results in an increase in the extent of western wheatgrass, bluegrama, and buffalograss and a decrease in the extent of bluestems and green needlegrass.

These soils generally are too steep for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. Soil loss would be excessive if cultivated crops were grown.

These soils generally are unsuited to windbreaks. If the slope is less than 9 percent, however, the Opal soil is suited to the trees or shrubs planted to enhance wildlife habitat, recreational areas, and other areas.

These soils generally are unsuitable as sites for buildings and sanitary facilities because of the slope and the high shrink-swell potential. Capability unit VIe-4; Opal soil in Clayey range site, Sansarc soil in Shallow Clay range site.

41A—Promise clay, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are irregular in shape and range from 5 to 250 acres in size. Slopes are smooth or slightly concave.

Typically, the surface layer is dark gray clay about 6 inches thick. The subsoil is about 10 inches of dark gray, firm clay over 8 inches of olive gray, calcareous clay. The underlying material to a depth of 60 inches is olive gray, calcareous clay. In places, shale is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Hurley and Grail soils. These soils make up less than 15 percent of any one mapped area. The Hurley soils are in slightly concave swales. They contain more salts in the subsoil than the Promise soil. The Grail soils contain less clay than the Promise soil. They occur as areas intermingled with some areas of that soil.

Permeability is slow in the Promise soil. Available water capacity is low or moderate. Organic matter content is moderate, and fertility is medium. Runoff is slow.

Most areas support native grass and are used for grazing or hay. A few areas are cultivated. This soil has good potential for rangeland. It has fair potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings and poor potential for most building sites and sanitary facilities.

The natural vegetation dominantly is western wheatgrass and green needlegrass and an understory of blue grama and buffalograss. Overgrazing causes an increase in the extent of western wheatgrass and blue grama. Continually overused rangeland is dominated by blue grama and buffalograss.

If this soil is farmed, the main concerns of management are controlling soil blowing, conserving moisture, and improving tilth. Crop residue management, stubble mulching, grasses and legumes in the cropping system, and chiseling or subsoiling improve tilth and water intake. Stripcropping helps control soil blowing.

Using this soil for tame pasture and hay is effective in controlling soil blowing and improving tilth. Suitable species for planting include alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass.

This soil is suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs can grow well. The main concerns of management are the limited rainfall; the clayey subsoil, which retards root growth; and soil blowing. Controlling competing vegetation enhances the survival and growth of plantings. This vegetation can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

This soil is poorly suited to most kinds of building site development because of the high shrink-swell potential. It generally is not suited to septic tank absorption fields because of restricted permeability. Lagoons and holding tanks are alternate waste disposal systems. Capability unit IIIs-3; Clayey range site.

41B—Promise clay, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and range from 5 to 150 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark gray clay about 6 inches thick. The subsoil is about 18 inches thick. It is dark gray, firm clay in the upper part and olive gray, calcareous clay in the lower part. The underlying material to a depth of 60 inches is olive gray, calcareous clay. In places, the depth to shale is 20 to 40 inches.

Included with this soil in mapping are small areas of Hurley and Grail soils. These soils make up less than 10 percent of any one mapped area. The Hurley soils are in swales and along drainageways. They contain more salts in the subsoil than the Promise soil. The Grail soils contain less clay than the Promise soil. They occur as areas intermingled with the areas of Promise soil in swales.

Permeability is slow in the Promise soil. Available water capacity is low or moderate. Organic matter content is moderate, and fertility is medium. The shrink-swell potential is high. Runoff is medium.

Most areas support native grass and are used for grazing or hay. Some areas are farmed. This soil has good potential for rangeland and fair potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has poor potential for most building sites and sanitary facilities.

The natural vegetation dominantly is western wheatgrass and green needlegrass and an understory of blue grama and buffalograss. Overgrazing causes an increase in the extent of western wheatgrass and blue grama. Continually overused sites are dominated by blue grama and buffalograss.

If this soil is farmed, the main concern of management is controlling erosion and soil blowing. Conserving moisture and maintaining tilth are other concerns. Crop residue management, stubble mulching, grasses and legumes in the cropping system, and chiseling or subsoiling improve tilth and water intake and help to control erosion. Stripcropping helps to control soil blowing. Grassed waterways help to keep gullies from forming.

Using this soil for tame pasture and hay is effective in controlling erosion and soil blowing and improving tilth. Suitable species for planting include alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass.

This soil is suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs can grow well. The main concerns of management are the limited rainfall; the clayey subsoil, which retards root growth; and soil blowing and erosion. Competing vegetation hinders the survival and growth of plantings. It can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

This soil is poorly suited to most kinds of building site development because of the high shrink-swell potential. It generally is not suitable as a septic tank absorption field because of the restricted permeability. Lagoons and holding tanks are alternate waste disposal systems. Capability unit IIIe-4; Clayey range site.

41C—Promise-Opal clays, 6 to 9 percent slopes. These deep and moderately deep, well drained, moderately sloping soils are on uplands. In places, a few scattered stones are on the surface. Areas are irregular in shape and range from 5 to 100 acres in size. They are 50 to 60 percent Promise soil and 30 to 40 percent Opal soil. The Promise soil is on the middle and lower parts of the landscape, and the Opal soil is on the higher, slightly convex parts of the landscape. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Promise soil has a surface layer of dark gray clay about 6 inches thick. The subsoil is about 18 inches thick. It is dark gray, firm clay in the upper part and olive gray, calcareous clay in the lower part. The underlying material to a depth of 60 inches is olive gray, calcareous clay.

Typically, the Opal soil has a surface layer of dark grayish brown clay about 5 inches thick. The subsoil is about 17 inches of very firm, calcareous clay. It is grayish brown in the upper part and light brownish gray in the lower part. The next 9 inches is light brownish gray, calcareous clay and shaly clay. Below this to a depth of 60 inches is gray shale.

Included with these soils in mapping are small areas of Hurley, Sansarc, and Sully soils. These included soils make up less than 10 percent of any one mapped area. The Hurley soil is in swales and on the lower parts of the landscape. It has more salts in the subsoil than the Promise and Opal soils. The Sansarc and Sully soils are on the tops of knolls and ridges. The Sansarc soils are shallow to shale. The Sully soils are silty.

Permeability is slow in the Promise soil and very slow in the Opal soil. Available water capacity is low or moderate in both soils. Organic matter content is moderate, and fertility is medium. The shrink-swell potential is high. Runoff is medium.

Most areas support native grass and are used for grazing and hay. Some areas are farmed. These soils have good potential for rangeland and fair potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. They have poor potential for most building sites and sanitary facilities.

The natural vegetation dominantly is western wheatgrass and green needlegrass and an understory of blue grama and buffalograss. If rangeland is overgrazed, the extent of western wheatgrass and blue grama increases. If it is continually overgrazed, these grasses are replaced by buffalograss and other short grasses.

If these soils are farmed, the main concerns of management are controlling erosion and soil blowing and improving tilth. Small grain and alfalfa are better suited than row crops because of the erosion hazard. Crop residue management, stubble mulching, and contour stripcropping help control erosion. Grassed waterways help to keep gullies from forming.

Using these soils for tame pasture and hay is effective in controlling erosion. Suitable species for planting include alfalfa, intermediate wheatgrass, and smooth bromegrass.

These soils are suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs can grow well. The main concerns of management are the limited rainfall; the clayey subsoils, which retard root growth; a severe erosion hazard; and competing vegetation.

These soils are poorly suited to most kinds of building site development because of the high shrink-swell potential. They generally are unsuitable as septic tank absorption fields because permeability is restricted in both soils and the Opal soil has bedrock at a moderate depth. Lagoons and holding tanks are alternate waste disposal systems. Capability unit IVe-4; Clayey range site.

51—Tonka silt loam. This deep, poorly drained, level soil is in closed depressions. It is frequently flooded for long periods. Areas are irregularly shaped or oval and range from 5 to 100 acres in size.

Typically, the surface layer is dark gray silt loam about 7 inches thick. The subsurface layer is gray silt loam about 8 inches thick. The subsoil is about 28 inches thick. It is gray, firm silty clay in the upper part and dark gray silty clay loam and clay loam in the lower part. The underlying material to a depth of 60 inches is pale olive, calcareous clay loam. In places, the surface layer is thinner.

Included with this soil in mapping are small areas of Bowbells and Parnell soils. These soils make up as much as 15 percent of any one mapped area. The Bowbells soils are along the edges of the depressions and are moderately well drained. The Parnell soils lack the gray subsurface layer characteristic of the Tonka soil. They occur as areas intermingled with some areas of that soil.

Permeability is slow in the Tonka soil. Available water capacity is high. This soil is moderate in organic matter content and is medium in fertility. The subsoil has a high shrink-swell potential. The water table ranges from 1 foot above the surface to 1 foot below during wet periods. The soil is ponded during wet periods.

Most large areas support native grass and are used for grazing or hay. Many small areas are cultivated with adjacent soils. This soil has fair potential for cultivated crops, tame pasture and hay, and rangeland. It has poor potential for windbreaks and environmental plantings, building sites, and sanitary facilities.

The natural vegetation dominantly is big bluestem. Switchgrass, indiangrass, western wheatgrass, and prairie cordgrass are less extensive. Overused rangeland is dominated by western wheatgrass, inland saltgrass, and Kentucky bluegrass. Sedges and rushes increase in extent during extended wet periods and short grasses during extended dry periods. If the rangeland is continually overused, western wheatgrass is replaced by short grasses, foxtail barley, sedges, and weeds.

This soil is suited to cultivated crops. Planting and harvesting may be delayed, however, during wet periods.

The choice of tame pasture plants is limited to water tolerant species because this soil is wet. Suitable species for planting include Garrison creeping foxtail and reed canarygrass. Natural drainage usually is not adequate, and artificial drainage is not feasible in most areas.

This soil generally is unsuited to windbreaks and environmental plantings. Inadequate drainage and the dense, compact subsoil restrict the growth of plantings. Trees are likely to drown out during wet periods.

This soil is poorly suited to building site development and most sanitary facilities because of flooding and wetness. Capability unit IVw-1; Closed Depression range site.

52A—Lehr loam, 0 to 3 percent slopes. This somewhat excessively drained, nearly level soil is on uplands. Areas are irregular in shape and range from 10 to 300 acres in size. Slopes are smooth or slightly convex.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. The subsoil is about 12 inches of very friable loam. It is dark grayish brown in the upper part and grayish brown and calcareous in the lower part. The underlying material to a depth of 60 inches is multicolored, calcareous sand and gravel. In places, the depth to sand and gravel is more than 20 inches.

Included with this soil in mapping are small areas of Bowbells and Wabek soils. These soils make up less than 10 percent of any one mapped area. The Bowbells

soils are in swales and are moderately well drained. The Wabek soils are on the tops of low knolls. They are shallower to sand and gravel than the Lehr soil.

Permeability is moderately rapid in the subsoil of the Lehr soil and rapid in the underlying sand and gravel. Available water capacity is low. This soil is moderate in organic matter content and medium in fertility. The porous underlying material limits the penetration of plant roots. Runoff is slow.

Many areas are cultivated. Some areas support native grass and are used for grazing or hay. Some areas are a source of sand and gravel. This soil has fair potential for cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings. It has good potential for most building sites and poor potential for most sanitary facilities.

This soil is droughty because it is shallow to sand and gravel. It is best suited to early maturing small grain. Conserving moisture is the main concern of management. Crop residue management and stubble mulching conserve moisture and help to maintain fertility.

The choice of pasture plants is limited by the low available water capacity and the shallow root zone. Crested wheatgrass is the best species for planting on tame pasture.

The natural grasses are needleandthread, threadleaf sedge, and blue and hairy grama. Overused rangeland is dominated by threadleaf sedge, blue grama, and weeds.

This soil is suited to windbreaks and environmental plantings. It is droughty, however, and has a shallow root zone that hinders the survival and growth of trees and shrubs. Competing vegetation also hinders the survival and growth of trees and shrubs. It can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

This soil is suitable as a building site. The sides of shallow excavations, however, are likely to cave in. The soil is well suited to septic tank absorption fields. The effluent from all sanitary facilities, however, can pollute shallow ground water. Capability unit IVs-1; Shallow to Gravel range site.

52B—Lehr loam, 3 to 6 percent slopes. This somewhat excessively drained, gently sloping soil is on uplands. It is in irregularly shaped areas that range from 10 to 500 acres in size. Slopes are smooth or slightly convex.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. The subsoil is about 12 inches of very friable loam. It is dark grayish brown in the upper part and grayish brown and calcareous in the lower part. The underlying material to a depth of 60 inches is multicolored, calcareous sand and gravel. In places, the depth to sand and gravel is more than 20 inches.

Included with this soil in mapping are small areas of Bowbells and Wabek soils. These soils make up less than 15 percent of any one mapped area. The Bowbells soils are in swales and are moderately well drained. The Wabek soils are on the tops of knolls. They are shallower to sand and gravel than the Lehr soil.

Permeability is moderately rapid in the subsoil of the Lehr soil and rapid in the underlying sand and gravel. Available water capacity is low. This soil is moderate in organic matter content and is medium in fertility. The porous underlying material limits the penetration of plant roots. Runoff is slow.

Many areas are cultivated. Some areas support native grass and are used for grazing or hay. Some areas are a source of sand and gravel. This soil has fair potential for cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings. It has good potential for most building sites and poor potential for most sanitary facilities.

This soil is droughty because it is shallow to sand and gravel. It is best suited to early maturing small grain. The main concerns of management are conserving moisture and controlling erosion. Crop residue management, stubble mulching, and grassed waterways conserve moisture and help to control erosion and maintain fertility.

The choice of pasture plants is limited by the shallow root zone and the low available water capacity. Crested wheatgrass is the best species for planting on tame pasture.

The natural grasses are needleandthread, threadleaf sedge, and blue and hairy grama. Overused rangeland is dominated by threadleaf sedge, blue grama, and weeds.

This soil is suited to windbreaks or environmental plantings, but it is droughty and has a shallow root zone that hinders the survival and growth of trees and shrubs. Competing vegetation also hinders the growth of trees and shrubs. It can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

This soil is suitable as a building site, but the sides of shallow excavations are likely to cave in. The soil is well suited to septic tank absorption fields. The effluent from all sanitary facilities, however, can pollute shallow ground water. Capability unit IVe-6; Shallow to Gravel range site.

53D—Wabek-Lehr loams, 6 to 15 percent slopes. These excessively drained and somewhat excessively drained, moderately sloping and rolling soils are on uplands and terraces. They are very shallow and shallow over sand and gravel. In some areas, scattered gravel and stones are on the surface. Areas are irregularly shaped or long and narrow and range from 10 to 200 acres in size. They are 45 to 55 percent Wabek soil and 35 to 45 percent Lehr soil. The Wabek soil is on the upper convex sides and tops of ridges and hills. The Lehr soil is on the lower and middle parts of the landscape. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Wabek soil has a surface layer of dark grayish brown loam about 6 inches thick. The underlying

material to a depth of 10 inches is dark grayish brown, calcareous gravelly loam. Below this to a depth of 60 inches is multicolored, calcareous sand and gravel. In cultivated areas, the surface layer is thinner, lighter colored, and calcareous.

Typically, the Lehr soil has a surface layer of dark grayish brown loam about 5 inches thick. The subsoil is about 12 inches of very friable loam. It is dark grayish brown in the upper part and grayish brown and calcareous in the lower part. The underlying material to a depth of 60 inches is multicolored, calcareous sand and gravel. In places, the depth to sand and gravel is more than 20 inches.

Included with these soils in mapping are small areas of Bowbells and Tally soils. These included soils make up less than 10 percent of any one mapped area. The Bowbells soils are moderately well drained and are in swales. The Tally soils do not have sand and gravel in the underlying material. They are on the lower parts of the landscape.

Permeability is rapid in the Wabek soil. It is moderately rapid in the subsoil of the Lehr soil and rapid in the underlying material. Available water capacity is low in both soils. The Wabek soil is moderate or low in organic matter content and low in fertility, and the Lehr soil is moderate in organic matter content and medium in fertility. The porous underlying material in both soils limits the penetration of roots. Runoff is slow.

Many areas support native grass and are used for grazing or hay. Small areas are cultivated with adjacent soils. Some areas are a source of sand and gravel. These soils have fair potential for most building sites. Because they are droughty, they have poor potential for cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings. The potential for most sanitary facilities also is poor.

The natural grasses are needleandthread, threadleaf sedge, and blue and hairy grama. Overused rangeland is dominated by threadleaf sedge, blue grama, and weeds. On continually overused rangeland, bare areas are prevalent and erosion is a serious problem.

These soils are suitable as building sites. Some land shaping may be needed, however, in the more sloping areas, and the sides of shallow excavations can cave in. The soils are suitable as septic tank absorption fields, but the effluent from all sanitary facilities can pollute shallow ground water. Capability unit VIe-5; Wabek soil in Very Shallow range site, Lehr soil in Shallow to Gravel range site.

53E—Wabek loam, 9 to 25 percent slopes. This excessively drained, strongly sloping or moderately steep soil is on ridges and hills. It is very shallow and shallow over sand and gravel. Scattered gravel and a few stones commonly are on the surface. Areas are long and narrow and range from 5 to 70 acres in size. Slopes are short and convex.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The underlying material to a depth of 10 inches is dark grayish brown, calcareous gravelly loam. Below this to a depth of 60 inches is multicolored, calcareous sand and gravel.

Included with this soil in mapping are small areas of Bowdle and Lehr soils. These soils make up less than 15 percent of any one mapped area. They are deeper to sand and gravel than the Wabek soil. They are on the lower and middle parts of the landscape.

Permeability is rapid in the Wabek soil. Available water capacity is low. Organic matter content is moderate or low, and fertility is low. Runoff is slow.

Most areas support native grass and are used for grazing. Some areas are a source of sand and gravel. Because it is droughty, this soil has poor potential for cultivated crops, rangeland, tame pasture and hay, and windbreaks and environmental plantings. It also has poor potential for building site development and sanitary facilities.

The natural grasses are needleandthread, blue and hairy grama, and threadleaf sedge. If rangeland is overused, the needleandthread is replaced by grama, threadleaf sedge, and weeds. On continually overused rangeland, bare areas are prevalent and erosion is a serious problem.

This soil is too steep for most buildings and sanitary facilities. The effluent from all sanitary facilities can pollute shallow ground water. Capability unit VIs-4; Very Shallow range site.

54—Divide loam, 0 to 4 percent slopes. This somewhat poorly drained or moderately well drained, nearly level soil is moderately deep over sand and gravel. It is on upland terraces. Areas are irregular in shape and range from 10 to 140 acres in size. Slopes are smooth or slightly convex.

Typically, the surface layer is calcareous loam about 10 inches thick. It is very dark gray in the upper part and dark gray in the lower part. The underlying material to a depth of 25 inches is friable, calcareous loam. It is gray in the upper part and light gray in the lower part. Below this to a depth of 60 inches is multicolored sand and gravel.

Included with this soil in mapping are small areas of Bowdle and Lehr soils. These soils make up less than 15 percent of any one mapped area. They are better drained than the Divide soil and occur as areas intermingled with areas of that soil.

Permeability is moderate in the upper part of the Divide soil and very rapid in the underlying sand and gravel. Available water capacity is low. This soil is moderate in organic matter content and is medium in fertility. It has lime in the surface layer. A fluctuating water table is at a depth of 2.5 to 5 feet during wet years. Runoff is slow.

Many areas are cultivated. Some areas support native grass and are used for grazing and hay. This soil has good potential for tame pasture and hay, rangeland, and windbreaks and environmental plantings. It has fair potential for cultivated crops and most building sites and poor potential for sanitary facilities.

This soil is suited to all of the crops commonly grown in the county. The high content of lime, however, adversely affects the availability of plant nutrients and results in susceptibility to soil blowing and, in dry years, early maturing of crops. The main concern of management is controlling soil blowing. Crop residue management, crop rotation, stripcropping, and stubble mulching help control soil blowing, conserve moisture, and maintain fertility.

Using this soil for tame pasture and hay is effective in controlling soil blowing. Species suitable for planting include alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass.

This soil is well suited to rangeland. The native vegetation is bluestems, western wheatgrass, and green needlegrass. Overused areas are dominated by western wheatgrass, needleandthread, and blue grama.

This soil is well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs can grow well. Competing vegetation hinders the survival and growth of plantings. It can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

This soil generally is suitable as a building site, but it is limited as a site for buildings with basements by the seasonal high water table. It is poorly suited to sanitary facilities because it is wet. Capability unit IIIs-4; Silty range site.

56—Regan silt loam. This deep, very poorly drained, nearly level soil is along drainageways. It is frequently flooded for brief to long periods. Areas are long and narrow or irregular in shape. They range from 10 to 240 acres in size. Slopes are smooth or concave.

Typically, the surface layer is calcareous silt loam about 10 inches thick. It is dark gray in the upper part and gray in the lower part. The next 5 inches is gray, calcareous silt loam. The underlying material to a depth of 60 inches is gray, calcareous silt loam over mottled, gray silty clay loam.

Included with this soil in mapping are small areas of Egas, Parnell, and Vallers soils. These soils make up less than 15 percent of any one mapped area. The Egas soils contain salts throughout. They occur as areas intermingled with areas of the Regan soil. The Parnell soils contain more clay than the Regan soil. They are in closed depressions. The Vallers soils are not so silty as the Regan soil. They are on the higher parts of the landscape.

Permeability is moderate in the Regan soil. Available water capacity is high. Organic matter content is moderate, and fertility is medium. The shrink-swell potential is moderate. The surface layer contains lime. The water table is at the surface or within a depth of 1 foot during wet periods. Runoff is slow.

Most areas support native grass and are used for grazing. Hay is harvested in some areas during dry years. This soil has fair potential for rangeland. It has poor potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, building sites, and sanitary facilities.

The natural vegetation mainly is prairie cordgrass, reedgrass, and sedges. Overgrazing results in an increase in the extent of sedges, rushes, saltgrass, and Kentucky bluegrass.

This soil generally is too wet for cultivated crops and windbreaks and environmental plantings. It is usually ponded or has a water table at or near the surface during the growing season.

Suitable species for tame pasture and hay include Garrison creeping foxtail and reed canarygrass. The number of suitable species is limited because natural drainage is not adequate and artificial drainage is not feasible.

This soil is poorly suited to building site development and sanitary facilities because of flooding, wetness, and shrinking and swelling. Capability unit Vw-4; Wetland range site.

57A—Williams-Bowbells loams, 0 to 3 percent slopes. These deep, well drained and moderately well drained, nearly level soils are on uplands. Areas are irregular in shape and range from 5 to more than 1,500 acres in size. They are 45 to 55 percent Williams soil and 35 to 45 percent Bowbells soil. The Williams soil is on the middle and upper convex parts of the landscape. The Bowbells soil is in swales and on the lower slightly concave parts of the landscape. It is frequently flooded for very brief periods. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Williams soil has a surface layer of dark grayish brown loam about 6 inches thick. The subsoil is about 19 inches of friable clay loam. It is brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has spots of lime that extend into the underlying material. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam. In places, lime is closer to the surface.

Typically, the Bowbells soil has a surface layer of dark grayish brown loam about 8 inches thick. The subsoil is about 15 inches of friable clay loam. It is dark grayish brown in the upper part and grayish brown in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous loam.

Included with these soils in mapping are small areas of Bryant and Tonka soils. These included soils make up less than 20 percent of any one mapped area. The

Bryant soils contain less clay in the subsoil than the Williams soil. They occur as areas intermingled with some areas of the Williams soil. The Tonka soils are poorly drained and are in closed depressions less than 5 acres in size.

Permeability is moderate through the subsoil of the Williams and Bowbells soils and moderately slow in the underlying material. Available water capacity is high. Organic matter content is moderate in the Willaims soil and high in the Bowbells soil. Fertility is medium in the Williams soil and high in the Bowbells soil. The shrink-swell potential is moderate in the subsoil of both soils. The Bowbells soil has a water table at a depth of 4 to 6 feet during wet periods. Runoff is slow or medium on both soils.

Most areas are cultivated. Some areas support native grass and are used for hay or grazing. These soils have good potential for cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings. The Williams soil has fair potential and the Bowbells soil poor potential for most building sites and sanitary facilities.

These soils are well suited to small grain, corn, alfalfa, and other crops. Planting and harvesting may be delayed during wet periods in areas of the Bowbells soil. Crop residue management and stubble mulching conserve moisture and maintain fertility.

These soils are well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable for planting.

The natural vegetation on the Williams soil is bluestems, western wheatgrass, and green needlegrass. That on the Bowbells soil is big bluestem and lesser amounts of switchgrass. Overused rangeland is dominated by western wheatgrass, needleandthread, and Kentucky bluegrass.

These soils are well suited to windbreaks and environmental plantings. Most of the climitically adapted trees and shrubs can grow well. Competing vegetation hinders the survival and growth of plantings. It can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

The Bowbells soil is poorly suited to building site development and sanitary facilities because it is subject to flooding. The Williams soil is a better site. Reinforcing foundations and footings helps to prevent the structure damage caused by shrinking and swelling. Enlarging septic tank absorption fields helps overcome the slow absorption of liquid waste. Capability unit IIc-2; Williams soil in Silty range site, Bowbells soil in Overflow range site.

57B—Williams-Bowbells loams, 3 to 6 percent slopes. These deep, well drained and moderately well drained, gently sloping or undulating soils are on uplands. Areas are irregular in shape and range from 10 to more than 1,500 acres in size. They are 45 to 55 percent Williams soil and 30 to 40 percent Bowbells soil. The Williams soil is on the higher convex parts of the landscape. The Bowbells soil is in swales and on the lower slightly concave parts of the landscape. In places, it is frequently flooded for very brief periods. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Williams soil has a surface layer of dark grayish brown loam about 6 inches thick. The subsoil is about 19 inches of friable clay loam. It is brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has spots of lime that extend into the underlying material. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam. In places, lime is closer to the surface.

Typically, the Bowbells soil has a surface layer of dark grayish brown loam about 8 inches thick. The subsoil is about 15 inches of friable clay loam. It is dark grayish brown in the upper part and grayish brown in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous loam.

Included with these soils in mapping are small areas of Bryant and Tonka soils. These included soils make up less than 25 percent of any one mapped area. The Bryant soils contain less clay in the subsoil than the Williams soil. They occur as areas intermingled with some areas of the Williams soil. The Tonka soils are poorly drained and are in closed depressions less than 5 acres in size.

Permeability is moderate through the subsoil of the Williams and Bowbells soils and moderately slow in the underlying material. Available water capacity is high. Organic matter content is moderate in the Williams soil and high in the Bowbells soil. Fertility is medium in the Williams soil and high in the Bowbells soil. The shrink-swell potential is moderate in the subsoil of both soils. Runoff is medium. In places, the Bowbells soil has a water table at a depth of 4 to 6 feet during wet periods.

Most areas are cultivated. Some areas support native grass and are used for hay or grazing. These soils have good potential for cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings. They have fair potential for most building sites and sanitary facilities.

These soils are well suited to small grain, corn, alfalfa, and other crops. The Bowbells soil is more productive because it receives runoff from the adjacent uplands. The additional moisture, however, may interfere with fieldwork in wet years. The main concerns of management are controlling erosion and conserving moisture. Crop residue management, contour farming, and stubble mulching help control erosion, conserve moisture, and maintain fertility. Grassed waterways help to keep gullies from forming.

These soils are well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable for planting.

The natural vegetation on rangeland is bluestems, western wheatgrass, and green needlegrass. Overused areas are dominated by western wheatgrass, needleandthread, and Kentucky bluegrass.

These soils are well suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs can grow well. Competing vegetation hinders the survival and growth of plantings. It can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

The Williams soil is a better building site than the Bowbells soil, which is subject to flooding. Reinforcing foundations and footings helps to prevent the structure damage caused by shrinking and swelling. Enlarging septic tank absorption fields helps overcome the slow absorption of liquid waste in both soils. Capability unit IIe-2; Silty range site.

57C—Williams-Vida loams, 6 to 9 percent slopes. These deep, well drained, moderately sloping or gently rolling soils are on uplands. A few scattered stones commonly are on the surface in the higher lying areas. Areas are irregular in shape and range from 5 to 600 acres in size. They are 45 to 55 percent Williams soil and 30 to 40 percent Vida soil. The Williams soil is on the lower and middle parts of the landscape. The Vida soil is on upper convex sides and tops of knolls and low hills. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Williams soil has a surface layer of dark grayish brown loam about 6 inches thick. The subsoil is about 19 inches of friable clay loam. It is brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has spots of lime that extend into the underlying material. The underlying material to a depth of 60 inches is calcareous, light brownish gray clay loam.

Typically, the Vida soil has a surface layer of dark grayish brown loam about 4 inches thick. The subsoil is about 16 inches of friable clay loam. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has spots of lime that extend into the underlying material. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam. Some very stony areas as much as 2 acres in size are on the higher parts of the landscape. Most of these areas support native grass.

Included with these soils in mapping are small areas of Bowbells, Bryant, Tonka, and Zahl soils. These included soils make up less than 25 percent of any one mapped area. The Bowbells soils are moderately well drained and are in swales. The Bryant soils contain less clay in the subsoil than the Williams and Vida soils. They occur as areas intermingled with areas of the Williams soil. The Tonka soils are poorly drained and are in closed depressions less than 5 acres in size. The Zahl soils have lime near the surface. They occur as areas intermingled with areas of the Vida soil.

Permeability is moderate through the subsoil of the Williams and Vida soils and moderately slow in the underlying material. Available water capacity is high. Organic matter content is moderate, and fertility is medium. The shrink-swell potential is moderate in the subsoil. Runoff is medium.

Most areas support native grass and are used for hay or grazing. Some areas are used for cultivated crops. These soils have good potential for cultivated crops, rangeland, tame pasture and hay, and windbreaks and environmental plantings. They have fair potential for most building sites and sanitary facilities.

The natural vegetation dominantly is bluestems, green needlegrass, and western wheatgrass. Overused rangeland is dominated by western wheatgrass, needleandthread, and blue grama.

All climatically adapted crops can grow on these soils. The Vida soil is less productive because the lime near the surface adversely affects the availability of plant nutrients. The main concerns of management are controlling erosion, conserving moisture, and maintaining fertility. Crop residue management, stubble mulching, and contour farming conserve moisture and help to maintain fertility and control erosion. If suitable, terraces are also effective in controlling erosion. Grassed waterways help to keep gullies from forming.

Using these soils for tame pasture and hay is an effective way to control erosion. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable for tame pasture and hay.

Windbreaks and environmental plantings can grow well on these soils. Planting trees on the contour helps control erosion and conserves moisture. Competing vegetation hinders survival and growth. It can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

Reinforcing the foundations and footings of buildings helps prevent the structure damage caused by the shrinking and swelling of these soils. Enlarging septic tank absorption fields helps overcome the slow absorption of liquid waste. Capability unit IIIe-2; Silty range site.

58B—Williams-Vida loams, 3 to 6 percent slopes. These deep, well drained, undulating soils are on uplands. Areas are irregular in shape and range from 5 to 200 acres in size. They are 45 to 55 percent Williams soil and 30 to 40 percent Vida soil. The Williams soil is on the lower and middle parts of the landscape. The Vida soil is on the upper convex sides and tops of low rises. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Williams soil has a surface layer of dark grayish brown loam about 6 inches thick. The subsoil is about 19 inches of friable clay loam. It is brown in the upper part and grayish brown in the lower part. The

lower part is calcareous and has spots of lime that extend into the underlying material. The underlying material to a depth of 60 inches is calcareous, light brownish gray clay loam.

Typically, the Vida soil has a surface layer of dark grayish brown loam about 4 inches thick. The subsoil is about 16 inches of friable clay loam. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has spots of lime that extend into the underlying material. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam.

Included with these soils in mapping are small areas of Bowbells, Bryant, Tonka, and Zahl soils. These included soils make up less than 25 percent of any one mapped area. The Bowbells soils are moderately well drained and are in swales. The Bryant soils contain less clay in the subsoil than the Williams and Vida soils. They occur as areas intermingled with areas of the Williams soil. The Tonka soils are poorly drained and are in closed depressions less than 5 acres in size. The Zahl soils have lime near the surface. They occur as areas intermingled with areas of the Vida soil.

Permeability is moderate through the subsoil of the Williams and Vida soils and moderately slow in the underlying material. Available water capacity is high. Organic matter content is moderate, and fertility is medium. The shrink-swell potential is moderate in the subsoil. Runoff is medium.

These soils are used for grazing and cultivated crops. They have good potential for cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings and fair potential for most building sites and sanitary facilities.

The natural vegetation dominantly is bluestems, green needlegrass, and western wheatgrass. Overused rangeland is dominated by western wheatgrass, needleandthread, and blue grama.

All climatically adapted cultivated crops can grow on these soils. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable for tame pasture and hay. The Vida soil is less productive because the high content of lime in the surface layer adversely affects the availability of plant nutrients. The main concerns of management are conserving moisture, controlling erosion, and maintaining fertility. Crop residue management and stubble mulching conserve moisture and help to maintain fertility and control erosion. Grassed waterways help to keep gullies from forming.

Windbreaks and environmental plantings grow well on these soils. Competing vegetation hinders the survival and growth of plantings. It can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

Reinforcing the foundations and footings of buildings helps prevent the structure damage caused by the shrinking and swelling of these soils. Enlarging septic tank absorption fields helps overcome the slow absorption of liquid waste. Capability unit IIe-2; Silty range site.

59D—Vida-Zahl loams, 6 to 15 percent slopes. These deep, well drained, moderately sloping to rolling soils are on uplands. Scattered stones are on the surface in most of the areas that support native grass. Areas are irregular in shape and range from 10 to more than 1,000 acres in size. They are 50 to 60 percent Vida soil and 30 to 40 percent Zahl soil. The Vida soil is on the lower and middle parts of the landscape. The Zahl soil is on the upper convex sides and tops of knolls and low hills. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Vida soil has a surface layer of dark grayish brown loam about 4 inches thick. The subsoil is about 16 inches of friable clay loam. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam. On the lower parts of the landscape, this soil is thicker and lime is leached to a greater depth. Some very stony areas as much as 2 acres in size are on the higher parts of the landscape. Most of these areas support native grass.

Typically, the Zahl soil has a surface layer of dark grayish brown loam about 5 inches thick. The underlying material to a depth of 60 inches is light brownish gray and calcareous. It is loam in the upper part and clay loam in the lower part. In places, this soil has a thinner surface layer and lime is at or near the surface.

Included with these soils in mapping are small areas of Bowbells, Bryant, Tonka, and Wabek soils. These included soils make up less than 20 percent of any one mapped area. The Bowbells soils are moderately well drained and are in swales. The silty Bryant soils are in small pockets and narrow strips. They occur as areas intermingled with some of the areas of Vida and Zahl soils. The Tonka soils are poorly drained and are in closed depressions less than 5 acres in size. The Wabek soils are shallow to gravel. They occur as areas intermingled with some areas of the Zahl soil.

Permeability is moderate in the upper part of the Vida and Zahl soils and moderately slow in the underlying material. Available water capacity is high. Organic matter content is moderate and fertility medium in the Vida soil. Organic matter content and fertility are low in the Zahl soil. The shrink-swell potential is moderate in both soils. Runoff is medium or rapid.

Most areas support native grass and are used for hay or grazing. Some of the less sloping areas are farmed. These soils have good potential for rangeland. They have fair potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings and for most building sites and sanitary facilities.

The natural vegetation on the Vida soil is bluestems, western wheatgrass, and green needlegrass. Overgrazed areas of this soil are dominated by western wheatgrass, needleandthread, and blue grama. The Zahl soil has a natural plant cover of little bluestem, sideoats grama, green needlegrass, and needleandthread. Overused areas of this soil are dominated by needleandthread, sideoats grama, and blue grama.

Cultivated areas are highly susceptible to erosion. The main concerns of management are controlling erosion and maintaining fertility. Soil blowing also is a concern on the Zahl soil. Crop residue management, stubble mulching, and contour farming conserve moisture and help to maintain fertility and control erosion and soil blowing.

Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable for tame pasture and hay. The lime near the surface of the Zahl soil adversely affects the availability of plant nutrients and reduces production.

The Vida soil is suitable for windbreaks and environmental plantings. Planting the trees and shrubs on the contour helps to control erosion. Control of competing vegetation conserves moisture. The Zahl soil generally is unsuited to windbreaks. If trees are planted on this soil, good survival and growth rates are unlikely.

Reinforcing the foundations and footings of buildings helps overcome the structure damage caused by the shrinking and swelling of these soils. Some land shaping may be necessary in the more sloping areas. These soils generally are too steep for most sanitary facilities. Septic tank absorption fields should be installed in the less sloping areas. Enlarging the absorption field helps overcome the slow absorption of liquid waste. Vida soil in capability unit IVe-3, Silty range site; Zahl soil in capability unit VIe-3, Thin Upland range site.

61E—Zahl-Vida loams, 9 to 30 percent slopes. These deep, well drained, strongly sloping to steep soils are on uplands. Scattered stones are on the surface in most of the areas that support native grass (fig. 7). Areas are long and narrow or irregular in shape and range from 5 to more than 300 acres in size. They are 45 to 55 percent Zahl soil and 35 to 45 percent Vida soil. The Zahl soil is on the upper convex sides and tops of knolls and hills. The Vida soil, which has a slope of 9 to 25 percent, is on the lower and middle parts of the landscape. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Zahl soil has a surface layer of dark grayish brown loam about 5 inches thick. The underlying material to a depth of 60 inches is light brownish gray and calcareous. It is loam in the upper part and clay loam in the lower part. In places, this soil has a thinner surface layer and lime is at or near the surface.

Typically, the Vida soil has a surface layer of dark grayish brown loam about 4 inches thick. The subsoil is about 16 inches of friable clay loam. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has spots of lime that extend into the underlying material. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam. In places, depth to the underlying material is more than 20 inches and lime is leached to a greater depth.

Figure 7.—Scattered stones on the surface in an area of Zahl-Vida loams, 9 to 30 percent slopes.

Included with these soils in mapping are small areas of Bowbells, Bryant, and Wabek soils. These included soils make up less than 20 percent of any one mapped area. The Bowbells soils are moderately well drained and are in swales. The silty Bryant soils are in small pockets and strips intermingled with the areas of Vida soil on the lower parts of the landscape. The Wabek soils are shallow or very shallow to sand and gravel. They are in small pockets and strips intermingled with some areas of the Zahl soil.

Permeability is moderate in the upper part of the Zahl and Vida soils and moderately slow in the underlying material. Available water capacity is high. Organic matter content and fertility are low in the Zahl soil. Organic matter content is moderate and fertility medium in the Vida soil. The shrink-swell potential is moderate in both soils. Runoff is rapid.

Most areas support native grass and are used for grazing. These soils have fair potential for rangeland and tame pasture and hay. They have poor potential for cultivated crops, windbreaks and environmental plantings, building sites, and most sanitary facilities.

The natural vegetation on the Zahl soil is little bluestem, sideoats grama, green needlegrass, and needleandthread. Overgrazed areas of this soil are dominated by needleandthread, sideoats grama, and blue grama.

The natural vegetation on the Vida soil is bluestems, western wheatgrass, and green needlegrass. If the rangeland is overused, these grasses are replaced by needleandthread, sideoats grama, and blue grama.

These soils generally are too steep and too shallow for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. They are too steep for buildings and most sanitary facilities. Capability unit VIe-3; Zahl soil in Thin Upland range site, Vida soil in Silty range site.

62—Vida very stony loam, 3 to 15 percent slopes. This deep, well drained, gently sloping to strongly sloping soil is on upland ridges. Areas are long and narrow or irregular in shape and range from 5 to 60 acres in size. Slopes are short and convex. Many stones are on the surface.

Typically, the surface layer is dark grayish brown very stony loam about 4 inches thick. The subsoil is about 6 inches of friable clay loam. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has spots of lime that extend into the underlying material. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam. In places, depth to the underlying material is more than 20 inches and lime is leached to a greater depth.

Included with this soil in mapping are small areas of Bryant, Wabek, and Zahl soils. These soils make up less than 15 percent of any one mapped area. The Bryant soils are on the lower parts of the landscape. The Wabek and Zahl soils occur as areas intermingled with areas of the Vida soil. The Wabek soils are shallow to sand and gravel. The Zahl soils have lime near the surface.

Permeability is moderate in the subsoil of the Vida soil and moderately slow in the underlying material. Available water capacity is high. Organic matter content is moderate, and fertility is medium. The shrink-swell potential is moderate in the subsoil. Runoff is medium.

Most areas support native grass and are used for grazing. This soil has good potential for rangeland. It has poor potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings and fair potential for building sites and most sanitary facilities.

The natural vegetation is bluestems, western wheatgrass, and green needlegrass. If the rangeland is overused, these grasses are replaced by needleandthread, sideoats grama, and blue grama.

This soil is too stony for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. Removing the many large stones is difficult.

If buildings are constructed on this soil, reinforcing the foundations and footings helps prevent the structure damage caused by shrinking and swelling. Large stones should be removed before construction. Enlarging septic tank absorption fields helps overcome the slow absorption of liquid waste in this soil. Capability unit VIIs-6; Silty range site.

65B—Bryant-Sutley silt loams, 2 to 6 percent slopes. These deep, well drained, very gently sloping soils are on uplands. They are in irregularly shaped areas that range from 10 to 450 acres in size. Slopes are smooth and convex. Individual areas are 50 to 60 percent Bryant soil and 25 to 35 percent Sutley soil. The Bryant soil is on the middle and lower parts of the landscape. The Sutley soil is on the higher parts of the landscape and the tops of low rises. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Bryant soil has a surface layer of dark grayish brown silt loam about 8 inches thick. The subsoil is about 16 inches of friable silt loam. It is brown in the upper part and light olive brown in the lower part. The lower part is calcareous. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In places, the soil contains less clay.

Typically, the Sutley soil has a surface layer of brown silt loam about 6 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam.

Included with these soils in mapping are small areas of Grassna, Vida, and Williams soils. These included soils make up less than 25 percent of any one mapped area. The Grassna soils are moderately well drained and are on the lower parts of the landscape and in swales. The Vida and Williams soils are not so silty as the Bryant and Sutley soils. They occur as areas intermingled with some areas of those soils.

Permeability is moderate in the Bryant and Sutley soils. Available water capacity is high. The Bryant soil is moderate in organic matter content and medium in fertility. The Sutley soil is low in organic matter content and fertility. The shrink-swell potential is moderate in the Bryant soil and low in the Sutley soil. Runoff is medium on both soils.

Most areas are cultivated. A few areas support native grass and are used for grazing or hay. These soils are suited to irrigation. They have good potential for cultivated crops, tame pasture and hay, and rangeland. The Bryant soil has good potential and the Sutley soil poor potential for windbreaks and environmental plantings. Both soils have fair potential for most building sites and sanitary facilities.

These soils are well suited to all of the cultivated crops commonly grown in the county. Such species as alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable for tame pasture and hay. The main concerns of management are conserving moisture and controlling erosion and soil blowing. Also, the lime in the Sutley soil adversely affects the availability of plant nutrients. Crop residue management, stubble mulching, and stripcropping help control erosion

and soil blowing, conserve moisture, and maintain fertility. Grassed waterways help to keep gullies from forming.

The natural vegetation on the Bryant soil is bluestems, western wheatgrass, and green needlegrass. Overused areas of this soil are dominated by western wheatgrass, needleandthread, and blue grama. The Sutley soil has a natural plant cover of little bluestem, sideoats grama, green needlegrass, and needleandthread. Overused areas are dominated by needleandthread, sideoats grama, and blue grama.

The Bryant soil is well suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs can grow well on this soil if competing vegetation is controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides. The Sutley soil is poorly suited to windbreaks and environmental plantings. No species of trees and shrubs can grow well on this soil. Climatically adapted trees and shrubs can be established as special plantings, but optimum survival, growth, and vigor are unlikely.

If buildings are constructed on the Bryant soil, reinforcing the foundations and footings helps prevent the structure damage caused by shrinking and swelling. Enlarging septic tank absorption fields helps overcome the slow absorption of liquid waste in this soil. The Sutley soil is well suited to septic tank absorption fields. Capability unit IIe-1; Bryant soil in Silty range site, Sutley soil in Thin Upland range site.

65C—Bryant-Sutley silt loams, 6 to 9 percent slopes. These deep, well drained, moderately sloping soils are on uplands. Areas are irregular in shape and range from 5 to 160 acres in size. They are 40 to 50 percent Bryant soil and 35 to 45 percent Sutley soil. The Bryant soil is on the middle and lower parts of the landscape. The Sutley soil is on the higher parts of the landscape and on the tops of low rises and knolls. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Bryant soil has a surface layer of dark grayish brown silt loam about 8 inches thick. The subsoil is about 16 inches of friable silt loam. It is brown in the upper part and light olive brown in the lower part. The lower part is calcareous. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In places, the soil contains less clay.

Typically, the Sutley soil has a surface layer of brown silt loam about 6 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In places, the surface layer has lighter colors.

Included with these soils in mapping are small areas of Grassna and Vida soils. These included soils make up less than 25 percent of any one mapped area. The Grassna soils are moderately well drained and are on the lower parts of the landscape and in swales. The Vida soils are not so silty as the Bryant and Sutley soils. They occur as areas intermingled with some areas of the Sutley soil.

Permeability is moderate in the Bryant and Sutley soils. Available water capacity is high. The Bryant soil is moderate in organic matter content and medium in fertility. The Sutley soil is low in organic matter content and in fertility. The shrink-swell potential is moderate in the Bryant soil and low in the Sutley soil. Runoff is medium on both soils.

Most areas are cultivated. A few areas support native grass and are used for grazing or hay. These soils have good potential for cultivated crops, tame pasture and hay, and rangeland. The Bryant soil has good potential and the Sutley soil poor potential for windbreaks and environmental plantings. Both soils have fair potential for building sites and sanitary facilities.

The Bryant soil is suited to all of the cultivated crops commonly grown in the county. Such species as intermediate wheatgrass and smooth bromegrass are suitable for tame pasture and hay. The main concerns of management are controlling erosion and soil blowing. The lime in the Sutley soil adversely affects the availability of plant nutrients. Crop residue management, stubble mulching, and stripcropping help control erosion and soil blowing, conserve moisture, and maintain fertility. Grassed waterways help to keep gullies from forming.

The natural vegetation on the Bryant soil is bluestems, western wheatgrass, and green needlegrass. Overgrazed areas of this soil are dominated by western wheatgrass, needleandthread, and blue grama. The Sutley soil has a natural plant cover of little bluestem, sideoats grama, green needlegrass, and needleandthread. Overgrazed areas are dominated by needleandthread, sideoats grama, and blue grama.

The Bryant soil is well suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs can grow well. Fallowing a year before the trees or shrubs are planted, cultivating, and applying herbicides help control competing vegetation and enhance the survival and growth of plantings. The Sutley soil is poorly suited to windbreaks. No species of trees and shrubs can grow well on this soil. Climatically adapted trees and shrubs can be established as special plantings, but optimum survival, growth, and vigor are unlikely. Planting the trees and shrubs on the contour helps control erosion.

Reinforcing the foundations and footings of the buildings constructed on the Bryant soil helps prevent the structure damage caused by shrinking and swelling. Enlarging septic tank absorption fields helps overcome the slow absorption of liquid waste in this soil. The Sutley soil is suitable as a septic tank absorption field. Land leveling and shaping are needed in some areas. Capability unit IIIe-2; Bryant soil in Silty range site, Sutley soil in Thin Upland range site.

65D—Sutley-Linton silt loams, 9 to 15 percent slopes. These deep, well drained, strongly sloping soils are on uplands. They are in irregularly shaped areas that range from 5 to 60 acres in size. Individual areas are 40 to 50 percent Sutley soil and 35 to 45 percent Linton soil. The Linton soil is on the middle and lower parts of the landscape. The Sutley soil is on the higher convex parts of the landscape and the tops of knolls. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Sutley soil has a surface layer of brown silt loam about 6 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In places, the surface layer has lighter colors.

Typically, the Linton soil has a surface layer of dark grayish brown silt loam about 7 inches thick. The subsoil is about 22 inches of friable silt loam. It is brown in the upper part and grayish brown and light brownish gray in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In places, the soil contains more clay.

Included with these soils in mapping are small areas of Grassna and Vida soils. These included soils make up less than 25 percent of any one mapped area. The Grassna soils are on the lower parts of the landscape and in swales and are moderately well drained. The Vida soils are not so silty as the Sutley and Linton soils. They occur as areas intermingled with areas of the Sutley soil.

Permeability is moderate in the Sutley and Linton soils. Available water capacity is high. The Linton soil is moderate in organic matter content and medium in fertility, and the Sutley soil is low in organic matter content and fertility. Runoff is medium on both soils.

Most areas support native grass and are used for grazing or hay. These soils have fair potential for tame pasture and hay, rangeland, windbreaks and environmental plantings, cultivated crops, most building sites, and sanitary facilities.

The natural vegetation on the Sutley soil mainly is little bluestem, green needlegrass, sideoats grama, and needleandthread. Overgrazed areas of this soil are dominated by needleandthread, sideoats grama, and blue grama. The natural vegetation on the Linton soil is bluestems, western wheatgrass, and green needlegrass. If the rangeland is overused, these grasses are replaced by western wheatgrass, needleandthread, and blue grama.

All of the climatically adapted cultivated crops can grow on these soils. Conserving moisture and controlling erosion and soil blowing are the main concerns of management. Also, the lime in the surface layer of the Sutley soil adversely affects the availability of plant nutrients. Crop residue management, stubble mulching, and stripcropping help control erosion and soil blowing, conserve moisture, and maintain fertility.

The Linton soil is suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs can grow well. The Sutley soil is poorly suited to windbreaks. Competing vegetation hinders the survival and growth of plantings. It can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides. Optimum growth and survival are unlikely on this soil.

These soils are suitable as sites for buildings and sanitary facilities, but considerable land shaping and leveling are needed. Capability unit IVe-1; Linton soil in Silty range site, Sutley soil in Thin Upland range site.

66—Arveson fine sandy loam. This deep, poorly drained, nearly level soil is on flood plains and in drainageways. It is frequently flooded for brief periods. Areas are long and narrow or irregular in shape and range from 5 to 80 acres in size. Slopes are smooth or slightly concave.

Typically, the surface layer is dark gray, calcareous fine sandy loam about 10 inches thick. The underlying material to a depth of 21 inches is gray, calcareous fine sandy loam. Below this to a depth of 60 inches is light brownish gray, calcareous loamy sand, fine sand, and sand.

Included with this soil in mapping are small areas of Hecla, Maddock, and Yecross soils. These soils make up less than 15 percent of any one mapped area. They are on higher parts of the landscape. They contain less clay than the Arveson soil.

Permeability is moderately rapid in the Arveson soil. Available water capacity is low. This soil is moderate in organic matter content and medium in fertility. The surface layer contains lime. The water table rises to the surface or to within 1 foot of the surface in the spring. Runoff is very slow.

Most areas support native grass and are used for grazing. During dry years, a few areas are used for hay. This soil has good potential for rangeland and fair potential for tame pasture and hay. It has poor potential for cultivated crops, windbreaks and environmental plantings, building sites, and sanitary facilities.

If used as rangeland, this soil produces an abundant stand of big bluestem and prairie cordgrass because the grasses benefit from the high water table. If the rangeland is overused, the natural grasses lose vigor and are replaced by inland saltgrass, western wheatgrass, and Kentucky bluegrass.

This soil is not suited to cultivated crops or windbreaks and environmental plantings because it is wet. Artificial drainage generally is not feasible.

The choice of tame pasture plants is limited mainly to water tolerant species. Suitable species include reed canarygrass, Garrison creeping foxtail, and western wheatgrass. Natural drainage is not adequate, and artificial drainage generally is not feasible.

This soil generally is unsuitable as a site for buildings and sanitary facilities because of the flooding and the wetness. Capability unit Vw-3; Subirrigated range site.

67A—Farnuf loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on upland terraces. Areas are irregular in shape and range from 5 to more than 600 acres in size. Slopes are smooth or convex.

Typically, the surface layer is dark grayish brown loam about 7 inches thick. The subsoil is about 18 inches of friable clay loam. It is dark brown in the upper part and brown in the lower part. The lower part is calcareous and has spots of lime that extend into the underlying material. The underlying material to a depth of 60 inches is calcareous loam. It is light brownish gray in the upper part and grayish brown in the lower part. The lower part has lenses of fine sandy loam.

Included with this soil in mapping are small areas of Bowbells, Bowdle, Grail, and Noonan soils. These soils make up less than 15 percent of any one mapped area. The Bowbells and Grail soils have dark colors below a depth of 16 inches. They are on the lower parts of the landscape and in swales. The Bowdle soils are 20 to 40 inches deep over sand and gravel. They occur as areas intermingled with areas of the Farnuf soil. The Noonan soils have a dense clayey subsoil. They are on the lower parts of the landscape.

Permeability is moderate in the Farnuf soil. Available water capacity is high. This soil is moderate in organic matter content and medium in fertility. The shrink-swell potential is moderate in the subsoil. Runoff is slow.

Most areas are cultivated. Some areas support native grass and are used for grazing or hay. This soil has good potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, rangeland, and most sanitary facilities. It has fair potential for most building sites.

This soil is well suited to small grain and corn. It also is well suited to alfalfa, intermediate wheatgrass, and smooth bromegrass for tame pasture and hay. Conserving moisture and maintaining fertility are the main concerns of management. Crop residue management and stubble mulching conserve moisture and help to maintain fertility.

The native vegetation is bluestems, green needlegrass, and lesser amounts of western wheatgrass. Overgrazed rangeland is dominated by western wheatgrass, blue grama, and needleandthread.

This soil is well suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs can grow well if competing vegetation is controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

Reinforcing the foundations and footings of the buildings constructed on this soil helps prevent the structure damage caused by shrinking and swelling. Enlarging the absorption area of septic tank absorption fields helps overcome the slow absorption of liquid waste. Capability unit IIc-2; Silty range site.

67B—Farnuf loam, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on upland terraces. Areas are irregular in shape and range from 5 to more than 350 acres in size. Slopes are smooth and convex.

Typically, the surface layer is dark grayish brown loam about 7 inches thick. The subsoil is about 18 inches of friable clay loam. It is dark brown in the upper part and brown in the lower part. The lower part is calcareous and has spots of lime that extend into the underlying material. The underlying material to a depth of 60 inches is calcareous loam. It is light brownish gray in the upper part and grayish brown in the lower part. The lower part has lenses of fine sandy loam.

Included with this soil in mapping are small areas of Bowbells, Bowdle, and Savage soils. These soils make up less than 15 percent of any one mapped area. The Bowbells soils are moderately well drained and are on the lower parts of the landscape and in swales. The Bowdle soils are 20 to 40 inches deep over sand and gravel. The Savage soils contain more clay in the subsoil than the Farnuf soil. They occur as areas intermingled with some areas of that soil.

Permeability is moderate in the Farnuf soil. Available water capacity is high. This soil is moderate in organic matter content and medium in fertility. The shrink-swell potential is moderate in the subsoil. Runoff is medium.

Many areas are cultivated. Some areas support native grass and are used for grazing or hay. This soil has good potential for cultivated crops, tame pasture and hay, rangeland, windbreaks and environmental plantings, and most sanitary facilities. It has fair potential for most building sites.

This soil is well suited to small grain and corn. It also is well suited to alfalfa, intermediate wheatgrass, and smooth bromegrass for tame pasture and hay. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management. Crop residue management, stubble mulching, and grassed waterways help control erosion, conserve moisture, and maintain fertility.

This soil is well suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs can grow well if competing vegetation is controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

The native vegetation is bluestems, green needlegrass, and lesser amounts of western wheatgrass. Overused rangeland is dominated by western wheatgrass, blue grama, and needleandthread.

Reinforcing the foundations and footings of the buildings constructed on this soil helps prevent the structure damage caused by shrinking and swelling. Enlarging the absorption area of septic tank absorption fields helps overcome the slow absorption of liquid waste. Capability unit IIe-1; Silty range site.

68A—Bryant-Grassna silt loams, 0 to 3 percent slopes. These deep, well drained and moderately well drained, nearly level soils are on uplands. Areas are irregular in shape and range from 5 to more than 600 acres in size. They are 40 to 50 percent Bryant soil and 35 to 45 percent Grassna soil. The Bryant soil is on the higher convex parts of the landscape. The Grassna soil is in swales and on the lower concave parts of the landscape. It is frequently flooded for very brief periods. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Bryant soil has a surface layer of dark grayish brown silt loam about 8 inches thick. The subsoil is about 16 inches of friable silt loam. It is brown in the upper part and light olive brown in the lower part. The lower part is calcareous. The underlying material to a depth of about 60 inches is light brownish gray, calcareous silt loam. In places, this soil contains less clay.

Typically, the Grassna soil has a surface layer of very dark gray silt loam about 13 inches thick. The subsoil is about 17 inches of friable silt loam. It is dark brown in the upper part and grayish brown in the lower part. The underlying material to a depth of 60 inches is light brownish gray and light yellowish brown, calcareous silt loam.

Included with these soils in mapping are small areas of Sutley and Tonka soils. These included soils make up less than 25 percent of any one mapped area. The Sutley soils have lime at or near the surface. They are on the tops of low rises. The Tonka soils are poorly drained and are in closed depressions less than 5 acres in size.

Permeability is moderate in the Bryant and Grassna soils. Available water capacity is high. The Bryant soil is moderate in organic matter content and is medium in fertility, and the Grassna soil is high in organic matter content and in fertility. The shrink-swell potential is moderate in both soils. The Grassna soil has a water table at a depth of 4 to 6 feet during wet periods. Runoff is slow on both soils.

Most areas are cultivated. Some areas support native grass and are used for grazing or hay. These soils are suited to irrigation. They have good potential for cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings. The Bryant soil has fair potential and the Grassna soil poor potential for most building sites and sanitary facilities.

These soils are well suited to all of the crops commonly grown in the county and to alfalfa, intermediate wheatgrass, and smooth bromegrass for tame pasture and hay. The main concern of management is conserving moisture. Crop residue management and stubble mulching conserve moisture and help to maintain fertility. Planting and harvesting may be delayed on the Grassna soil during wet periods.

These soils are well suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs can grow well. Competing vegetation hinders the survival and growth of plantings. It can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

These soils are well suited to rangeland. The native vegetation on the Bryant soil is bluestems, western wheatgrass, and green needlegrass. That on the Grassna soil is big bluestem and lesser amounts of switchgrass. Overused areas are dominated by western wheatgrass, needleandthread, and Kentucky bluegrass.

The Grassna soil is poorly suited to building site development and septic tank absorption fields because it is subject to flooding. The Bryant soil is a better site. Reinforcing foundations and footings helps prevent the structure damage caused by shrinking and swelling. Enlarging septic tank absorption fields helps overcome the slow absorption of liquid waste in the Bryant soil. Capability unit IIc-2; Bryant soil in Silty range site, Grassna soil in Overflow range site.

68B—Bryant silt loam, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and range from 10 to more than 600 acres in size. Slopes are smooth and convex.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 16 inches of friable silt loam. It is brown in the upper part and light olive brown in the lower part. The lower part is calcareous. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In places, the soil contains less clay.

Included with this soil in mapping are small areas of Grassna, Sutley, and Williams soils. These soils make up less than 10 percent of any one mapped area. The Grassna soils are moderately well drained and are on the lower parts of the landscape and in swales. The Sutley soils are on the higher parts of the landscape. They have lime at or near the surface. The Williams soils contain more clay and sand in the subsoil than the Bryant soil. They occur as areas intermingled with a few areas of that soil.

Permeability is moderate in the Bryant soil. Available water capacity is high. This soil is moderate in organic matter content and medium in fertility. The shrink-swell potential is moderate. Runoff is medium.

Most areas are cultivated. Some areas support native grass and are used for grazing or hay. This soil has good potential for cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings. It has fair potential for most building sites and sanitary facilities.

This soil is well suited to small grain, corn, and alfalfa. The main concerns of management are controlling erosion and conserving moisture. Crop residue management, stubble mulching, and contour farming help control erosion, conserve moisture, and maintain fertility. Grassed waterways help to keep gullies from forming.

Using this soil for tame pasture or hay is effective in controlling erosion. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs can grow well if competing vegetation is controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

The native vegetation is bluestems, western wheatgrass, and green needlegrass. Overused rangeland is dominated by western wheatgrass, needleandthread, and Kentucky bluegrass.

If buildings are constructed on this soil, reinforcing the foundations and footings helps prevent the structure damage caused by shrinking and swelling. Enlarging septic tank absorption fields helps overcome the slow absorption of liquid waste in this soil. Capability unit IIe-1; Silty range site.

68C—Bryant silt loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on uplands. Areas are irregular in shape and range from 10 to 100 acres in size. Slopes are smooth and convex.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 16 inches of friable silt loam. It is brown in the upper part and light olive brown in the lower part. The lower part is calcareous. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In places, the soil contains less clay.

Included with this soil in mapping are small areas of Grassna, Sutley, Vida, and Williams soils. These soils make up less than 15 percent of any one mapped area. The Grassna soils are moderately well drained and are in swales. The Sutley soils have lime at or near the surface. They are on the upper parts of the landscape. The Vida and Williams soils contain more sand in the subsoil than the Bryant soil. They occur as areas intermingled with a few areas of that soil.

Permeability is moderate in the Bryant soil. Available water capacity is high. This soil is moderate in organic matter content and medium in fertility. The shrink-swell potential is moderate. Runoff is medium.

Many areas are cultivated. Some areas support native grass and are used for grazing or hay. This soil has good potential for cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings. It has fair potential for most building sites and sanitary facilities.

This soil is well suited to small grain, corn, and alfalfa. Controlling erosion and conserving moisture are the main concerns of management. Crop residue management, stubble mulching, contour farming, and grassed waterways help control erosion, conserve moisture, and maintain fertility.

Using this soil for tame pasture or hay is effective in controlling erosion. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs can grow well. They should be planted on the contour to help control erosion. Fallowing a year before the trees or shrubs are planted, cultivating, and applying herbicides help control competing vegetation and thus enhance the survival and growth of plantings.

The native vegetation is bluestems, western wheatgrass, and green needlegrass. Overused rangeland is dominated by western wheatgrass, needleandthread, and Kentucky bluegrass.

If buildings are constructed on this soil, reinforcing the foundations and footings helps prevent the structure damage caused by shrinking and swelling. Enlarging septic tank absorption fields helps overcome the slow absorption of liquid waste in this soil. Capability unit IIIe-1; Silty range site.

71—Ranslo-Harriet silt loams. These deep, somewhat poorly drained and poorly drained, level soils are on flood plains. They are occasionally flooded for very brief to long periods. Areas are irregular in shape and range from 10 to more than 600 acres in size. They are 50 to 60 percent Ranslo soil and 25 to 35 percent Harriet soil. The Ranslo soil is on slight rises, and the Harriet soil is in slight depressions. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Ranslo soil has a surface layer of dark gray silt loam about 8 inches thick. The next 4 inches is dark gray clay loam and gray silt loam. The subsoil is about 22 inches thick. It is dark gray, firm clay loam in the upper part and grayish brown, firm silty clay loam in the lower part. The lower part has spots of lime that extend into the underlying material. The underlying material to a depth of 60 inches is olive gray, calcareous silty clay loam.

Typically, the Harriet soil has a surface layer of gray silt loam about 2 inches thick. The subsoil is about 12 inches of dark gray, firm clay. The lower part has nests of salts that extend into the underlying material. The underlying material to a depth of 60 inches is gray, light gray, and light brownish gray, calcareous silty clay. In places, this soil contains less clay.

Included with these soils in mapping are small areas of Farnuf and Straw soils. These included soils make up less than 25 percent of any one mapped area. The Farnuf soils are well drained and are on the higher parts of the landscape. The Straw soils do not have a dense clayey subsoil. They are along drainageways.

Permeability is slow in the Ranslo and Harriet soils. Available water capacity is moderate. These soils are moderate in organic matter content and medium in fertility. The shrink-swell potential is high. The dense, com-

pact subsoil in both soils has a concentration of sodium that restricts root growth and reduces the amount of water released to plants. During wet periods, the water table is at a depth of 3 to 5 feet in the Ranslo soil and within a depth of 1 foot in the Harriet soil. Runoff is slow on both soils.

Most areas support native grass and are used for grazing. The Ranslo soil has good potential for rangeland and fair potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The Harriet soil has fair potential for rangeland and poor potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. Both soils have poor potential for building sites and most sanitary facilities.

Both soils are best suited to rangeland. The natural grasses on the Ranslo soil are big bluestem, switchgrass, and prairie cordgrass. If the rangeland is overused, the natural grasses lose vigor and are replaced by inland saltgrass, western wheatgrass, and Kentucky bluegrass. The Harriet soil has a plant cover that dominantly is alkali sacaton, saltgrass, and western wheatgrass. If the rangeland is overused, the stand thins out severely. Grazing during wet periods causes surface compaction. As a result of this compaction, the extent of the better grasses decreases.

The Ranslo soil is better suited to small grain than to corn because the dense, compact subsoil limits the depth to which roots can penetrate. The Harriet soil generally is unsuited to cultivated crops. Crop residue management, chiseling or subsoiling, and grasses and legumes in the cropping system improve water intake and conserve moisture.

The grasses suitable for planting include Garrison creeping foxtail, reed canarygrass, and tall wheatgrass. Pasturing when these soils are wet causes surface compaction, which further hinders the infiltration of rainfall.

The Ranslo soil is suited to windbreaks and environmental plantings. Most of the climatically adapted trees and shrubs can grow well. The Harriet soil generally is unsuited to windbreaks and environmental plantings. Trees and shrubs do not survive or grow well on this soil.

These soils are unsuitable as sites for buildings and most sanitary facilities because they are wet and subject to flooding. Ranslo soil in capability unit IIIw-4, Subirrigated range site; Harriet soil in capability unit VIw-4, Saline Lowland range site.

72—Straw loam, channeled. This deep, well drained, nearly level soil is on flood plains that have been dissected by stream channels. It is occasionally flooded for brief periods. Areas are long and narrow and range from 5 to 100 acres in size.

Typically, the surface layer is loam about 23 inches thick. It is very dark gray in the upper part and dark gray in the lower part. The underlying material to a depth of 60 inches is dark gray, dark grayish brown, and grayish brown, stratified loam, sandy loam, and clay loam.

Included with this soil in mapping are small areas of Egas, Farnuf, Harriet, and Ranslo soils. These soils make up less than 15 percent of any one mapped area. The Egas, Harriet, and Ranslo soils contain more clay than the Straw soil and have salts in the subsoil. They occur as areas intermingled with some areas of the Straw soil. The Farnuf soils contain more clay in the subsoil than the Straw soil. They are on the higher parts of the landscape.

Permeability is moderate in the Straw soil. Available water capacity is high. Organic matter content and fertility also are high. The shrink-swell potential is moderate. The water table is at a depth of 4 to 6 feet during the spring in most years. Runoff is slow.

Most areas support native grass and are used for grazing or hay. Strips and clumps of trees and shrubs commonly are along the stream channels. This soil has good potential for rangeland and tame pasture and hay. It has poor potential for cultivated crops, building sites, sanitary facilities, and windbreaks and environmental plantings.

This soil is best suited to rangeland. The natural plant cover dominantly is big bluestem and lesser amounts of switchgrass and green needlegrass. If the rangeland is overused, the natural grasses lose vigor and are replaced by western wheatgrass and Kentucky bluegrass.

As a result of the meandering channels and the flooding, farming is impractical in most areas. Areas that are accessible to farm machinery can be used for tame pasture and hay. The soil is suited to such species as alfalfa, intermediate wheatgrass, and smooth bromegrass. Silt and debris left by floodwaters in some years can damage pasture plants and hinder haying.

This soil generally is unsuited to windbreaks. Trees and shrubs can be planted for special purposes only if the most favorable sites and the species that have the best potential to survive and grow well are selected.

This soil is poorly suited to building site development and sanitary facilities because of the flooding. Capability unit VIw-3; Overflow range site.

74A—Savage silt loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on upland terraces. Areas are irregular in shape and range from 10 to 200 acres in size. Slopes are smooth and convex.

Typically, the surface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is about 17 inches of firm silty clay. It is dark grayish brown in the upper part and grayish brown and very pale brown in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material to a depth of 60 inches is grayish brown and light yellowish brown, calcareous silty clay loam. In places, this soil contains less clay.

Included with this soil in mapping are small areas of Bowbells, Grail, and Tonka soils. These soils make up less than 15 percent of any one mapped area. The Bowbells and Grail soils have dark colors below a depth of 16 inches. They are in swales and on the lower parts of the landscape. The Bowbells soils are moderately well drained. The Tonka soils are poorly drained and are in closed depressions less than 5 acres in size.

Permeability is moderately slow in the Savage soil. Available water capacity is moderate. Organic matter content also is moderate, and fertility is medium. The shrink-swell potential is high. Runoff is medium.

About half of the areas are used for crops, and half support native grass. This soil has good potential for cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings. It has poor potential for most building sites and sanitary facilities.

This soil is well suited to small grain and corn. Suitable species for tame pasture and hay include alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Crop residue management, stubble mulching, and crop rotation conserve moisture and help to maintain fertility.

The natural vegetation dominantly is western wheatgrass and green needlegrass and an understory of blue grama and buffalograss. If the rangeland is overused, the extent of western wheatgrass and blue grama increases. After continual overuse, blue grama and buffalograss occupy the site.

This soil is well suited to all of the climatically adapted trees and shrubs. Windbreaks and environmental plantings can grow well if competing vegetation is controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

This soil is poorly suited to building site development because of the high shrink-swell potential. If buildings are constructed on this soil, reinforcing the foundations and footings helps to prevent the structure damage caused by shrinking and swelling. Enlarging septic tank absorption areas helps overcome the slow absorption of liquid waste in this soil. Capability unit IIc-2; Clayey range site.

74B—Savage silt loam, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on upland terraces. Areas are irregular in shape and range from 10 to 160 acres in size. Slopes are smooth and convex.

Typically, the surface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is about 17 inches of firm silty clay. It is dark grayish brown in the upper part and grayish brown and very pale brown in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material to a depth of 60 inches is grayish brown and light yellowish brown, calcareous silty clay loam. In places, this soil contains less clay.

Included with this soil in mapping are small areas of Grail and Noonan soils. These soils make up less than 10 percent of any one mapped area. The Grail soils have dark colors below a depth of 16 inches. They are in swales and on the lower parts of the landscape. The Noonan soils have sodium in the subsoil. They occur as areas intermingled with some areas of the Savage soil.

Permeability is moderately slow in the Savage soil. Available water capacity is moderate. Organic matter content also is moderate, and fertility is medium. The shrink-swell potential is high. Runoff is medium.

About half of the areas are used for crops, and half support native grass. This soil has good potential for cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings. It has poor potential for most building sites and sanitary facilities.

This soil is well suited to small grain and corn. Suitable species for tame pasture and hay are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Crop residue management and stubble mulching help control erosion, conserve moisture, and maintain fertility. Grassed waterways help to keep gullies from forming.

The natural vegetation dominantly is western wheatgrass and green needlegrass and an understory of blue grama and buffalograss. If the rangeland is overused, the extent of western wheatgrass and blue grama increases. After continued overuse, blue grama and buffalograss occupy the site.

This soil is well suited to all of the climatically adapted trees and shrubs. Windbreaks and environmental plantings can grow well if competing vegetation is controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

This soil is poorly suited to building site development because of the high shrink-swell potential. If buildings are constructed on this soil, reinforcing the foundations and footings helps to prevent the structure damage caused by shrinking and swelling. Enlarging septic tank absorption fields helps overcome the slow absorption of liquid waste in this soil. Capability unit IIe-1; Clayey range site.

77—Pits, gravel. These areas are open excavations, 5 to 30 feet deep, from which sand and gravel has been removed. They are irregular in shape and range from 5 to 80 acres in size. Slopes are uneven and broken. They range from nearly level on the pit bottoms to almost vertical on the rims. Some of the pit bottoms are covered with water.

The pit bottoms typically are sand and gravel, but they are loam or clay loam glacial till or silty glacial drift where all of the sand and gravel has been removed. Mounds of mixed loamy overburden are on the edges of the areas. The bottoms and sides support little or no vegetation during periods when the pits are used.

Most gravel pits can be used only as a source of sand and gravel for construction purposes. Some provide limited wildlife habitat. Abandoned gravel pits can be restored to range, tame pasture, or cropland if reclamation measures are applied. These measures include shaping the areas and using the mounds of overburden material as a topsoil dressing. Applying fertilizer as needed helps to establish range or pasture. Capability unit VIIIs-2; not assigned to a range site.

80—Ranslo silt loam. This deep, somewhat poorly drained, level soil is on terraces and flood plains. It is occasionally flooded for very brief periods. Areas are long and narrow or irregular in shape and range from 10 to 350 acres in size. Slopes are smooth or slightly concave.

Typically, the surface layer is dark gray silt loam about 8 inches thick. The next 4 inches is dark gray clay loam and gray silt loam. The subsoil is about 22 inches thick. It is dark gray, firm clay loam in the upper part and grayish brown, firm silty clay loam in the lower part. The lower part has spots of lime that extend into the underlying material. The underlying material to a depth of 60 inches is olive gray, calcareous silty clay loam.

Included with this soil in mapping are small areas of Farnuf, Harriet, and Straw soils. These soils make up less than 10 percent of any one mapped area. The Farnuf soils are well drained and are on the higher parts of the landscape. They do not contain so much clay in the subsoil as the Ranslo soil. The Harriet soils are poorly drained and are in slight depressions. The Straw soils do not contain so much clay as the Ranslo soil. They occur as areas intermingled with some areas of that soil.

Permeability is slow in the Ranslo soil. Available water capacity is moderate. This soil is moderate in organic matter content and medium in fertility. The subsoil has a high shrink-swell potential. Because it is dense and compact, it restricts root growth. The water table is at a depth of 3 to 5 feet during wet periods. Runoff is slow.

Most areas support native grass and are used for grazing or hay. Some areas are cultivated. This soil has good potential for rangeland and fair potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has poor potential for building sites and most sanitary facilities.

The natural grasses are big bluestem, switchgrass, and prairie cordgrass. If the rangeland is overused, the natural grasses lose vigor and are replaced by saltgrass, western wheatgrass, and Kentucky bluegrass.

This soil is better suited to small grain than to corn because the dense, compact subsoil limits the depth to which roots can penetrate. The grasses suitable for planting on pasture include Garrison creeping foxtail, reed canarygrass, and tall wheatgrass. Crop residue management, chiseling or subsoiling, and grasses and legumes in the cropping system improve water intake and conserve moisture.

This soil is suited to windbreaks and environmental plantings if it is adequately drained. Climatically adapted trees and shrubs grow well because of the abundant supply of moisture. Competing vegetation hinders the survival and growth of plantings. It can be controlled by cultivating and by applying herbicides.

This soil is unsuitable as a site for buildings and most sanitary facilities because it is wet and subject to flooding. Capability unit IIIw-4; Subirrigated range site.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, rangeland, and woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

Ralph W. Stensland, conservation agronomist, Soil Conservation Service, helped prepare this section.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

About 60 percent of the land in Campbell County is used for crops, tame hay, and tame pasture (*9*). The major crops are spring wheat, alfalfa, corn, and oats. Barley, flax, and rye also are grown. Spring wheat is grown for grain, alfalfa is harvested mainly for hay, corn is harvested for both silage and grain, and oats is used as a cash crop and as livestock feed.

The potential of the soils in Campbell County for increased crop production is good. Food production could be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology.

Soil erosion and *soil blowing* are the major problems on almost 68 percent of the cropland, hayland, and pasture in Campbell County. If the slope is more than 2 percent, erosion is a hazard on such soils as Bowdle, Bryant, Farnuf, Hamerly, Linton, Opal, Promise, Savage, Sutley, and Williams.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on clayey soils, such as Opal and Promise, on soils having a claypan subsoil, such as Noonan, and on soils that have a thin surface layer, such as Sully and Sutley. Erosion also reduces productivity on soils that tend to be droughty, such as Bowdle and Divide. Second, erosion on farmland results in sediment entering streams and lakes. Controlling erosion minimizes the pollution of streams and lakes by sediment and improves water quality for fish and wildlife, recreation, and municipal use.

A cropping system that keeps vegetative cover on the soil for extended periods holds soil losses to amounts that will not reduce the productive capacity of the soils. In areas where crops do not protect the soil, careful management of crop residue is essential. On livestock farms, including legumes and forage crops in the cropping system reduces the risk of erosion on sloping land and provides nitrogen and improves tilth for the next crop.

Slopes are so short and irregular that contour farming or terracing is not practical in most areas of the sloping Vida and Williams soils. On these soils, cropping systems that provide substantial vegetative cover are needed to control erosion.

Minimizing tillage and leaving crop residue on the surface increase the infiltration rate and reduce the risks of runoff and erosion. Together with grassed waterways, they are suitable on most soils in the survey area.

Terraces and diversions reduce the length of slopes and the risks of runoff and erosion. They are most practical on deep, well drained soils that have long, smooth slopes, such as Bryant, Linton, and Promise. These soils also are well suited to contour farming or contour stripcropping. Many of the other soils are less suitable for terraces and diversions because of short, irregular slopes or an unfavorable subsoil that would be exposed in terrace channels.

Soil blowing is a slight to severe hazard on many of the soils in the county. The hazard is especially severe on Arveson, Hecla, Maddock, Parshall, and Tally soils. The clayey Opal and Promise soils and the soils that have a high content of lime, such as Divide, Hamerly, Regan, Sutley, Vallers, and Zahl, also are highly susceptible. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. An adequate plant cover, a cover of crop residue, and a rough surface minimize soil blowing on these soils. Windbreaks of adapted trees and shrubs also are effective in reducing the risk of soil blowing.

Information about the design of erosion control practices for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Soil drainage is the major management need on the poorly drained Arveson, Tonka, and Vallers soils. Unless artificially drained, these soils are so wet that crops are frequently damaged. If a drainage outlet is available, open ditch drainage helps to remove excess water. Con-

trolling runoff on adjacent slopes also reduces the wetness.

The moderately well drained Bowbells and Grassna and well drained Grail and Straw soils on stream terraces, flood plains, and flats and in upland swales receive additional moisture when streams occasionally overflow or when water runs off higher lying adjacent soils. During wet years, tillage and planting are delayed in the spring, but in most years drainage is adequate and the additional moisture is beneficial for most crops. Artificial drainage is rarely needed on these soils.

Soil fertility should be maintained so that maximum yields can be obtained. The amounts and kinds of fertilizer needed on soils that have a high content of lime in the surface layer, such as Divide, Hamerly, Regan, Sutley, and Vallers, generally differ from the amounts and kinds needed on soils that do not have lime in the surface layer. Grasses and legumes in the cropping system help maintain fertility. On all soils, additions of fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer needed.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous. Tilth is poor in clayey soils, such as Opal and Promise. These soils dry out slowly in the spring and are difficult to till. If they are farmed when wet, they tend to be very cloddy when dry and preparing a good seedbed is difficult. Timely tillage, grasses and legumes in the cropping system, and crop residue management improve tilth and water intake.

Field crops suited to the soils and climate of the survey area include close growing crops and row crops. Spring wheat and oats are the main close growing crops. Barley, rye, and flax also are suited but are grown on a lesser acreage. Corn is the main row crop. A small acreage is planted to sorghum. In dryfarmed areas, these row crops commonly are harvested for silage. Sunflowers are sometimes grown in these areas.

All commonly grown and climatically adapted crops are suited to deep, well drained and moderately well drained soils, such as Bowbells, Bryant, Farnuf, Grail, Grassna, Linton, Savage, Vida, and Williams.

Arveson and Bowdle soils are better suited to early maturing small grain than to deeper rooted corn and alfalfa because the porous underlying material limits the depth to which roots can penetrate and the available water capacity. Hecla, Maddock, Tally, Wyndmere, and Yecross soils are better suited to close growing crops than to row crops because soil blowing is a hazard if these soils are row cropped. Clayey soils, such as Opal and Promise, are better suited to spring wheat and other small grains and alfalfa than to row crops.

Pasture plants best suited to the climate and to most of the soils in the survey area include alfalfa, intermediate wheatgrass, and smooth bromegrass. Crested wheatgrass is well suited to soils that tend to be droughty, such as Bowdle, Divide, and Lehr, and to soils that are low in fertility and high in content of lime, such as Sully, Sutley, and Zahl. Bunch-type species, such as crested wheatgrass and Russian wildrye, should not be planted in areas where the slope is more than 6 percent because erosion is a hazard in these areas.

If the poorly drained and very poorly drained Arveson, Heil, Parnell, Tonka, and Vallers soils are pastured, the choice of pasture plants is limited to water tolerant species, such as Garrison creeping foxtail and reed canarygrass.

Proper stocking rates, timely deferment of grazing, and applications of fertilizer help to keep the pasture in good condition. If the pasture is overgrazed, the grasses lose vigor and die and are usually replaced by annual grasses and weeds.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 5.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The estimated yields reflect the productive capacity of the soils for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system (*7*), all kinds of soil are grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class; they are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability unit is identified in the description of each soil mapping unit in the section "Soil maps for detailed planning." Capability units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-2 or IIIe-1.

Rangeland

More than 30 percent of the acreage of Campbell County is rangeland. More than half of the farm income is derived from livestock, principally cattle. Cow-calf-steer operations are predominant throughout the county. The average size of farms or ranches is about 1,100 acres.

The rangeland generally occurs as scattered small tracts throughout the county. Larger tracts occur as areas of Sansarc and Opal soils near the Oahe Reservoir and as areas of Zahl, Vida, and Williams soils in the southeastern part of the county. The soils used as rangeland generally are too steep or too shallow for cultivated crops.

On many farms, the forage produced on rangeland is supplemented by crop stubble. In winter, the native forage is often supplemented with protein concentrate.

The native vegetation in many parts of the survey area has been greatly depleted by continued excessive use. Much of the acreage that was once mixed prairie is now covered with short grasses and weeds. The amount of forage produced may be less than half of that originally produced. Productivity of the range can be increased by applying management that is effective on specific kinds of soil and range sites.

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 6 shows, for each kind of soil, the name of the range site; the total annual production of vegetation in

favorable, normal, and unfavorable years; the characteristic vegetation; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed cannot support a natural plant community of predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 6.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Characteristic vegetation refers to the grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil. They are listed by common name. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Native woods and windbreaks and environmental plantings

David L. Hintz, forester, Soil Conservation Service, helped prepare this section.

About 2,500 acres in Campbell County, or less than 1 percent of the acreage, supports native trees and shrubs. The soils that support trees and shrubs are not classified as woodland soils. The trees and shrubs generally grow in the areas on rangeland where soil and water relationships favor their establishment and growth. They are used for watershed protection, recreational purposes, and wildlife food and habitat.

Most of the trees and shrubs grow near the margins of natural lakes and wetlands and on the breaks and along the drainageways near Lake Oahe. American elm, American plum, boxelder, bur oak, common chokecherry, green ash, silver buffaloberry, skunkbush sumac, western snowberry, and several species of wild rose grow on the Lihen, Opal, and Promise soils on the breaks and along the drainageways adjacent to Lake Oahe. American plum, peachleaf willow, plains cottonwood, sandbar willow, and western snowberry are common on the margins of natural lakes, wetlands, and drainageways.

Windbreaks have been planted since the days of the early settlers. They were planted primarily to protect farmsteads and livestock. Such windbreaks are still needed. In recent years, field windbreaks have been planted to help control soil blowing. They are still needed on thousands of acres in the county.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field, the interval depending on erodibility of the soil. They protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. A healthy planting stock of suitable species planted properly on a well prepared site and maintained in good condition can insure a high degree of plant survival.

Table 7 shows the height that locally grown trees and shrubs are expected to reach on various kinds of soil in 20 years. The estimates in table 7 based on measurements and observation of established plantings that have

been given adequate care, can be used as a guide in planning windbreaks and screens. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from nurserymen.

Wildlife habitat

John B. Farley, biologist, Soil Conservation Service, helped prepare this section.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants (fig. 8).

In table 8, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if

Figure 8.—Lake Campbell. The trees and shrubs and other vegetation provide habitat for wildlife. The lake is used for recreational activities in summer.

the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are intermediate wheatgrass, smooth bromegrass, sweet clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, western wheatgrass, and grama grasses.

Hardwood trees are planted trees and shrubs that provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of native woody plants are bur oak, cottonwood, chokecherry, green ash, boxelder, hawthorn, silver buffaloberry, American plum, hackberry, and currant. Examples of fruit-producing shrubs and small trees that are commercially available and suitable for planting on soils rated *good* are Russian-olive, honeysuckle, and crabapple.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, cattail, and cordgrass and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, shallow dugouts, level ditches, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and trees. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous and woody plants. The kinds of wildlife attracted to these areas include ring-necked pheasant, gray partridge, meadowlark, mourning dove, field sparrow, cottontail, racoon, and red fox.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include antelope, whitetail deer, jackrabbit, coyote, sharp-tailed grouse, meadowlark, and lark bunting.

Recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 11, and interpretations for dwellings without basements and for local roads and streets, given in table 10.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They have moderate slopes and have few or no stones or boulders on the surface.

Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material

below a depth of 5 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 10 shows, for each kind of soil, the degree and kind of limitations for building site development; table 11, for sanitary facilities. Table 13 shows the kind of limitations for water management. Table 12 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 10. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 5 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 10 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the compressibility and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 10 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 11 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive

maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons (aerobic) are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments. These limitations do not apply to anaerobic lagoons.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 11 apply only to the soil material within a depth of about 5 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 12 by ratings of good, fair, or poor. The texture, thickness, and organic matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 5 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or

cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 14 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 12 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 5 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 14.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 13, the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water-control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfa-

vorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features and engineering test data.

Engineering properties

Table 14 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 14 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 14 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 17. The estimated classification, without group index numbers, is given in table 14. Also in table 14 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard)

is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index is estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation, liquid limit, and plasticity index extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 15 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 15. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values in this survey area range from 0.10 to 0.43. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 16 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table, that is, perched or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horse-

power tractor, but hard bedrock generally requires blasting.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Engineering test data

The results of analyses of engineering properties of several typical soils of the survey area are given in table 17.

The data presented are for soil samples that were collected from carefully selected sites. The soil profiles sampled are typical of the series discussed in the section "Soil series and morphology." The soil samples were analyzed by the South Dakota Department of Transportation, Division of Highways.

The methods used in obtaining the data are listed by code in the next paragraph. Most of the codes, in parentheses, refer to the methods assigned by the American Association of State Highway and Transportation Officials. The codes for shrinkage and Unified classification are those assigned by the American Society for Testing and Materials.

The methods and codes are AASHTO classification (M-145-66); Unified classification (D-2487-69); mechanical analysis (T88-57); liquid limit (T89-60); plasticity index (T90-56); and moisture-density, method A (T99-57).

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*6*). Unless otherwise noted, matrix colors described are for dry soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Arveson series

The Arveson series consists of deep, poorly drained soils that formed in loamy and sandy alluvium. Permeability is moderately rapid. These soils contain large amounts of calcium carbonate. They are along drainageways. Slopes range from 0 to 2 percent.

Arveson soils commonly are near Hecla, Maddock, and Yecross soils and are similar to Regan, Vallers, and Wyndmere soils. Regan soils are fine-silty, and Vallers soils are fine-loamy. Wyndmere soils are somewhat poorly drained. Hecla, Maddock, and Yecross soils are sandy and lack a calcic horizon.

Typical pedon of Arveson fine sandy loam, 425 feet north and 550 feet west of the southeast corner of sec. 35, T. 125 N., R. 76 W.

A1—0 to 10 inches; dark gray (10YR 4/1) fine sandy loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, friable; slight effervescence; moderately alkaline; clear smooth boundary.

C1gca—10 to 21 inches; gray (N 5/0) fine sandy loam, dark gray (N 4/0) moist; weak medium subangular blocky structure; slightly hard, friable; strong effervescence; moderately alkaline; clear smooth boundary.

C2gca—21 to 29 inches; light brownish gray (2.5Y 6/2) loamy sand, grayish brown (2.5Y 5/2) moist; common medium distinct mottles, light gray (10YR 7/1) moist, and few fine distinct mottles, yellowish brown (10YR 5/6) moist; single grained; slightly hard, friable; strong effervescence; moderately alkaline; gradual smooth boundary.

C3g—29 to 60 inches; light brownish gray (2.5Y 6/2) fine sand and sand, grayish brown (2.5Y 5/2) moist; many coarse prominent mottles, yellowish brown (10YR 5/6) and light gray (10YR 7/1) moist; single

grained; loose; strong effervescence; moderately alkaline.

The calcium carbonate equivalent ranges from 15 to 30 percent in some part of the C horizon within a depth of 16 inches. The mollic epipedon is 7 to 20 inches thick.

The A horizon is neutral in hue or has hue of 10YR, 2.5Y, or 5Y, value of 2 or 3 moist, and chroma of 1 or 2. It is fine sandy loam, sandy loam, or loam and is 4 to 14 inches thick. It is mildly alkaline or moderately alkaline. Some pedons have an A12 horizon. The Cca horizon is neutral in hue or has hue of 2.5Y or 5Y, value of 4 to 7 moist, and chroma of 1 or 2. It is fine sandy loam, sandy loam, loam, or loamy sand. The C3 horizon has hue of 2.5Y or 5Y, value of 5 or 6 moist, and chroma of 1 or 2. It is sandy loam, loamy sand, fine sand, or sand. It is mildly alkaline or moderately alkaline.

Bowbells series

The Bowbells series consists of deep, moderately well drained soils formed in alluvium and in glacial till. Permeability is moderate in the solum and moderately slow in the underlying material. These soils are in upland swales. Slopes range from 0 to 6 percent.

Bowbells soils commonly are near Tonka and Williams soils and are similar to Grail and Grassna soils. Tonka soils are poorly drained. Williams soils have a mollic epipedon that is less than 16 inches thick. Grail soils have a finer textured subsoil than Bowbells soils. Grassna soils are fine-silty.

Typical pedon of Bowbells loam, 1,986 feet east and 210 feet south of the northwest corner of sec. 23, T. 128 N., R. 74 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure parting to weak fine and medium granular; slightly hard, friable; neutral; abrupt smooth boundary.

B21t—8 to 16 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; moderate fine and medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; gradual smooth boundary.

B22t—16 to 23 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; gradual smooth boundary.

C1ca—23 to 34 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—34 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 22 to more than 32 inches. The solum ranges from slightly acid to moderately alkaline.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 2 or 3. It is 5 to 15 inches thick. The B2t horizon has hue of 10YR or 2.5Y, value of 4 to 6 (2 to 4 moist), and chroma of 2 or 3. It is clay loam or loam. Its clay content may average as low as 25 percent and as high as 35 percent. The C horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 to 4. It is loam or clay loam.

Bowdle series

The Bowdle series consists of well drained soils that are moderately deep over sand and gravel. Permeability is moderate in the loamy sediments and rapid in the underlying sand and gravel. These soils are on upland terraces. Slopes range from 0 to 6 percent.

The Bowdle soils in Campbell County have lower chroma than is defined as the range for the series. This difference, however, does not alter the use or behavior of these soils.

Bowdle soils commonly are near Lehr and Wabek soils and are similar to Divide soils. Lehr and Wabek soils are shallower to sand and gravel than Bowdle soils. Divide soils have a calcic horizon.

Typical pedon of Bowdle loam, 0 to 3 percent slopes, 2,634 feet north and 180 feet east of the southwest corner of sec. 28, T. 125 N., R. 75 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) loam, black (10YR 2/1) moist; moderate fine and medium granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

B21—6 to 10 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; neutral; clear wavy boundary.

B22—10 to 18 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; common very fine pores; mildly alkaline; clear wavy boundary.

Cca—18 to 25 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate fine prismatic structure parting to moderate fine subangular blocky; slightly hard, friable; few very fine

pores; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

IIC—25 to 60 inches; multicolored sand and gravel; single grained; loose; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 15 to 30 inches. The depth to sand and gravel ranges from 20 to 40 inches. The mollic epipedon ranges from 16 to 30 inches in thickness.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is 4 to 8 inches thick. It is silt loam or loam. The B horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is loam that may average as low as 18 percent clay and as high as 25 percent clay. Some pedons have a B3 horizon. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. It is loam, gravelly loam, or sandy loam.

Bryant series

The Bryant series consists of deep, well drained soils formed in loess or silty glacial drift. Permeability is moderate. These soils are on uplands. Slopes range from 0 to 9 percent.

Bryant soils are near Grassna, Linton, Sutley, Vida, and Williams soils. Grassna soils have a mollic epipedon that is more than 16 inches thick. Linton and Sutley soils are coarse-silty. Vida and Williams soils have an argillic horizon and are fine-loamy.

Typical pedon of Bryant silt loam, 3 to 6 percent slopes (fig. 9), 2,583 feet west and 189 feet north of the southeast corner of sec. 36, T. 125 N., R. 78 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine and medium subangular blocky structure; soft, friable; neutral; abrupt smooth boundary.

B21—8 to 14 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable; neutral; gradual smooth boundary.

B22—14 to 18 inches; light olive brown (2.5Y 5/4) silt loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable; neutral; gradual smooth boundary.

B3ca—18 to 24 inches; light olive brown (2.5Y 5/4) silt loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable; few fine and medium accumulations of carbonate; violent effervescence; moderately alkaline; gradual smooth boundary.

C1ca—24 to 36 inches; light brownish gray (2.5Y 6/2) silt loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable; few fine accumulations of car-

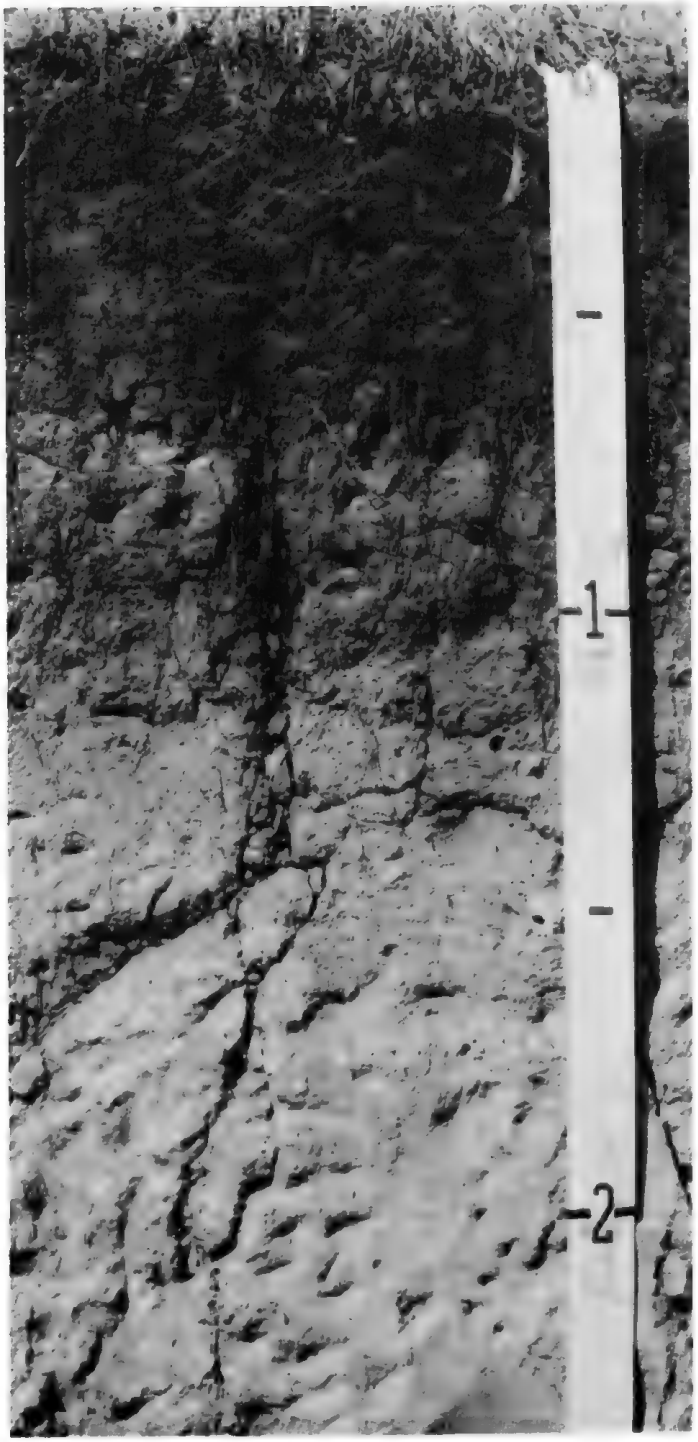


Figure 9.—Profile of Bryant silt loam, 3 to 6 percent slopes. The dark colored surface layer is about 8 inches thick.

bonate; violent effervescence; moderately alkaline; gradual smooth boundary.

C2—36 to 60 inches; light brownish gray (2.5Y 6/2) silt loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 11 to 30 inches. The depth to free carbonates ranges from 12 to 24 inches. The mollic epipedon is 7 to 16 inches thick.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is silt loam or loam that is 5 to 8 inches thick. The B2 horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. It is silt loam, loam, or silty clay loam that may average as low as 18 percent clay and as high as 28 percent clay. Some pedons lack a B3ca horizon. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is loam, silt loam, or silty clay loam. In some pedons, loam or clay loam glacial till is within a depth of 40 to 60 inches.

Divide series

The Divide series consists of somewhat poorly drained or moderately well drained soils that are moderately deep over sand and gravel. Permeability is moderate in the loamy sediments and very rapid in the underlying sand and gravel. These soils are on terraces. They formed in loamy alluvium over sand and gravel. Slopes range from 0 to 4 percent.

Divide soils commonly are near Bowdle, Lehr, and Regan soils and are similar to Hamerly soils. Bowdle and Lehr soils lack a calcic horizon. Hamerly soils are fine-loamy. Regan soils are very poorly drained. They do not have sand and gravel within a depth of 40 inches.

Typical pedon of Divide loam, 0 to 4 percent slopes, 70 feet west and 65 feet north of the southeast corner of sec. 4, T. 125 N., R. 74 W.

Ap—0 to 6 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak coarse subangular blocky structure parting to moderate fine granular; slightly hard, friable; slight effervescence; mildly alkaline; abrupt smooth boundary.

A12—6 to 10 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak coarse subangular blocky structure parting to weak fine and medium subangular blocky; slightly hard, friable; strong effervescence; mildly alkaline; clear irregular boundary.

C1ca—10 to 20 inches; gray (10YR 6/1) loam, gray (10YR 5/1) moist; few fine faint mottles, yellowish brown (10YR 5/8) moist; weak coarse subangular blocky structure; slightly hard, friable; common fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

C2ca—20 to 25 inches; light gray (10YR 7/1) loam, gray (10YR 6/1) moist; few fine faint mottles, yellowish brown (10YR 5/8) moist; massive; slightly hard, friable; common fine accumulations of carbonate; violent effervescence; moderately alkaline; clear smooth boundary.

IIC3—25 to 60 inches; multicolored sand and gravel; single grained; loose; strong effervescence; moderately alkaline.

The depth to sand and gravel is 20 to 36 inches. The calcium carbonate equivalent is 15 to 30 percent in some part of the C horizon within a depth of 16 inches. The mollic epipedon is 7 to 16 inches thick.

The A horizon has hue of 10YR or 2.5Y and value of 3 to 5 (2 or 3 moist). It is loam, sandy loam, or silt loam and is 7 to 16 inches thick. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (3 to 6 moist), and chroma of 1 or 2. It is loam or clay loam.

Egas series

The Egas series consists of deep, poorly drained soils that formed in loamy and clayey alluvial material. Permeability is slow. These soils are on bottom land. Slopes range from 0 to 2 percent.

The Egas soils in Campbell County contain less clay between depths of 10 and 40 inches than is defined as the range for the series. This difference, however, does not alter the use or behavior of these soils.

Egas soils commonly are near Harriet and Ranslo soils, both of which have a natric horizon.

Typical pedon of Egas silty clay loam, 1,550 feet west and 15 feet south of the northeast corner of sec. 23, T. 128 N., R. 77 W.

A11sa—0 to 2 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark gray (10YR 3/1) moist; moderate very fine granular structure; slightly hard, friable; common fine nests of salts; strongly alkaline; abrupt smooth boundary.

A12sa—2 to 9 inches; grayish brown (10YR 5/2) silty clay loam, black (10YR 2/1) moist; moderate coarse subangular blocky structure; hard, firm, sticky and plastic; common fine to coarse nests of salts; slight effervescence; strongly alkaline; abrupt smooth boundary.

ACg—9 to 24 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; common fine distinct mottles of yellowish brown (10YR 5/6); weak coarse subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; slight effervescence; strongly alkaline; gradual wavy boundary.

C1g—24 to 36 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; common fine distinct mottles of yellowish brown (10YR 5/6); massive; slightly hard, firm, sticky and slightly plastic; slight effervescence; strongly alkaline; gradual wavy boundary.

C2g—36 to 60 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; common fine distinct mottles of yellowish brown (10YR 5/6); massive; slightly hard, firm, slightly sticky and slightly plastic; slight effervescence; strongly alkaline.

Salts are within a depth of 7 inches and typically form visible crusts on the surface. Free carbonates are within a depth of 10 inches. The mollic epipedon is 8 to 22 inches thick.

The A11 horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is silt loam or silty clay loam. The A12 and AC horizons have hue of 10YR, 2.5Y, or 5Y, value of 4 or 5 (2 to 4 moist), and chroma of 1 or 2. The A1 horizon is 3 to 18 inches thick and is mildly alkaline to strongly alkaline. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 or 5 moist), and chroma of 1 or 2. It is moderately alkaline or strongly alkaline.

Farnuf series

The Farnuf series consists of deep, well drained soils formed in alluvium. Permeability is moderate. These soils are on upland terraces. Slopes range from 0 to 6 percent.

Farnuf soils commonly are near Bowdle and Grail soils and are similar to Savage soils. The Bowdle soils have sand and gravel within a depth of 20 to 40 inches. The Grail and Savage soils have a finer textured subsoil than Farnuf soils. In addition, Grail soils have a mollic epipedon that is more than 16 inches thick.

Typical pedon of Farnuf loam, 0 to 3 percent slopes, 250 feet west and 25 feet north of the southeast corner of sec. 17, T. 128 N., R. 78 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; soft, very friable; neutral; abrupt smooth boundary.

B21t—7 to 11 inches; dark brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

B22t—11 to 17 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; shiny films on faces of peds; mildly alkaline; clear wavy boundary.

B3ca—17 to 25 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate fine and medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine and medium accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C1ca—25 to 43 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few medium accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C2—43 to 47 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C3—47 to 60 inches; grayish brown (2.5Y 5/2) loam having thin lenses of fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 10 to 18 inches. The mollic epipedon is 10 to 12 inches thick.

The A horizon has value of 2 or 3 moist and chroma of 2 or 3. The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 2 to 4. It is clay loam or silty clay loam. In some pedons, the C horizon has common accumulations of carbonate.

Flasher series

The Flasher series consists of shallow, somewhat excessively drained soils formed in residuum of soft sandstone. Permeability is rapid. These soils are on uplands. Slopes range from 25 to 50 percent.

Flasher soils commonly are near Lihen, Linton, and Sully soils. The Lihen and Linton soils have a mollic epipedon. The Linton and Sully soils are coarse-silty.

Typical pedon of Flasher loamy fine sand, 25 to 50 percent slopes, 800 feet west and 1,360 feet north of the southeast corner of sec. 2, T. 128 N., R. 79 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak very fine and fine granular structure parting to single grained; loose; neutral; gradual wavy boundary.

C1—5 to 10 inches; olive brown (2.5Y 4/4) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; weak very fine and fine granular structure parting to single grained; loose; mildly alkaline; gradual smooth boundary.

C2—10 to 18 inches; light yellowish brown (2.5Y 6/4) fine sand, olive brown (2.5Y 4/4) moist; single

grained; loose; mildly alkaline; few fragments of soft sandstone; clear broken boundary.

Cr1—18 to 22 inches; light olive brown (2.5Y 5/4) soft sandstone crushing to fine sand, olive brown (2.5Y 4/4) moist; slightly hard, but brittle; mildly alkaline; gradual wavy boundary.

Cr2—22 to 60 inches; light yellowish brown (2.5Y 6/4) soft sandstone crushing to fine sand, olive brown (2.5Y 4/4) moist; massive crushing to single grained; mildly alkaline.

The control section ranges from neutral to moderately alkaline and in places contains free carbonates. The depth to soft sandstone is 10 to 20 inches.

The A horizon has hue of 10YR or 2.5Y, value of 4 to 6 (2 to 4 moist), and chroma of 2 or 3. It is loamy fine sand, loamy sand, sandy loam, or fine sandy loam. It is 4 to 8 inches thick. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 8 (3 to 6 moist), and chroma of 2 to 4.

Grail series

The Grail series consists of deep, well drained soils formed in loamy and clayey alluvium on terraces. Permeability is moderately slow. Slopes range from 0 to 3 percent.

The Grail soils in Campbell County have lower chroma than is defined as the range for the series. This difference, however, does not alter the use or behavior of these soils.

Grail soils commonly are near Farnuf, Promise, and Savage soils and are similar to Bowbells and Grassna soils. Bowbells and Farnuf soils are fine-loamy. Farnuf and Savage soils have a mollic epipedon that is less than 16 inches thick. Grassna soils are fine-silty. Promise soils have a finer textured subsoil than Grail soils.

Typical pedon of Grail silty clay loam, 170 feet north and 2,350 feet east of the southwest corner of sec. 4, T. 128 N., R. 79 W.

Ap—0 to 6 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

B21t—6 to 21 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak medium and coarse prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; shiny films on faces of peds; neutral; gradual smooth boundary.

B22tca—21 to 38 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate coarse subangular blocky; very hard, firm, sticky and plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

Cca—38 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine accumulations and striations of carbonate; strong effervescence; mildly alkaline.

The solum ranges from 20 to more than 40 inches in thickness. Reaction ranges from neutral to moderately alkaline throughout the profile. The mollic epipedon is more than 16 inches thick.

The A horizon has value of 2 or 3 moist and chroma of 1 or 2. It is silt loam, silty clay loam, or clay loam. The B2 horizon has value of 2 to 4 moist and chroma of 1 to 3. It may average as low as 35 percent clay and as high as 45 percent clay. The C horizon is loam, silty clay loam, silty clay, or clay.

Grassna series

The Grassna series consists of deep, moderately well drained soils formed in silty alluvium. Permeability is moderate. These soils are in swales on uplands. Slopes range from 0 to 3 percent.

The Grassna soils in Campbell County have lower chroma in the A horizon than is defined as the range for the series. This difference, however, does not alter the use or behavior of these soils.

Grassna soils commonly are near Bryant, Linton, and Tonka soils and are similar to Bowbells and Grail soils. Bowbells soils are fine-loamy. Bryant and Linton soils have a mollic epipedon that is less than 16 inches thick. In addition, Linton soils are coarse-silty. Grail and Tonka soils have a finer textured subsoil than Grassna soils. In addition, Tonka soils are poorly drained.

Typical pedon of Grassna silt loam, 2,355 feet west and 72 feet north of the southeast corner of sec. 13, T. 125 N., R. 78 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam, black (10YR 2/1) moist; weak fine and medium subangular blocky and weak fine granular structure; slightly hard, friable, plastic; neutral; abrupt smooth boundary.

A12—7 to 13 inches; very dark gray (10YR 3/1) silt loam, black (10YR 2/1) moist; weak medium prismatic structure parting to weak medium and coarse subangular blocky; hard, friable; neutral; clear smooth boundary.

B21—13 to 26 inches; dark brown (10YR 4/3) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium and coarse subangular blocky; hard, friable; neutral; gradual smooth boundary.

B22—26 to 30 inches; grayish brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; hard, friable; neutral; gradual smooth boundary.

C1ca—30 to 40 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak fine subangular blocky structure; hard, friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—40 to 60 inches; light yellowish brown (2.5Y 6/4) silt loam, olive brown (2.5Y 4/4) moist; common fine distinct relic mottles, gray (5Y 5/1) and dark yellowish brown (10YR 4/6) moist; massive; hard, friable; few fine and medium accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 36 inches. The control section may average as low as 18 percent clay and as high as 26 percent clay. The mollic epipedon is 16 to 28 inches thick.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is 7 to 18 inches thick. The B2 horizon has value of 4 or 5 (3 or 4 moist) and chroma of 2 or 3. It is silt loam or silty clay loam. The C horizon has value of 6 or 7 (4 to 6 moist) and chroma of 2 to 4.

Hamerly series

The Hamerly series consists of deep, somewhat poorly drained soils that are moderately permeable in the upper horizons and moderately slowly permeable in the underlying material. These soils formed in glacial till on uplands. Slopes range from 0 to 6 percent.

Hamerly soils commonly are near Bowbells, Tonka, and Williams soils and are similar to Divide soils. The Bowbells, Tonka, and Williams soils have an argillic horizon and lack a calcic horizon. The Divide soils have sand and gravel within a depth of 20 to 40 inches.

Typical pedon of Hamerly silt loam, 0 to 3 percent slopes, 2,190 feet north and 180 feet east of the southwest corner of sec. 11, T. 125 N., R. 75 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak fine and medium granular structure; soft, friable; slight effervescence; mildly alkaline; abrupt smooth boundary.

A12—8 to 11 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak fine prismatic structure parting to moderate fine subangular blocky; slightly hard, friable; slight effervescence; mildly alkaline; clear smooth boundary.

C1ca—11 to 23 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; hard, friable; violent effervescence; mildly alkaline; clear smooth boundary.

C2—23 to 42 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; few fine distinct mottles, yellowish brown (10YR 5/6) moist; massive; hard, friable, slightly sticky and slightly plastic; common medium accumulations of carbonate; violent effervescence; moderately alkaline; clear smooth boundary.

C3cs—42 to 60 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; few fine faint and distinct mottles, yellowish brown (10YR 5/6) and light gray (10YR 7/1) moist; massive; hard, friable; few fine accumulations of carbonate; common crystals of gypsum; violent effervescence; moderately alkaline.

Reaction ranges from neutral to moderately alkaline throughout the profile. In the areas that support native grass, the upper few inches are leached of carbonates. The calcium carbonate equivalent ranges from 18 to 30 percent in some part of the C horizon within a depth of 16 inches.

The A horizon has hue of 10YR or 2.5Y, value of 2 or 3 moist, and chroma of 1 or 2. It is 5 to 14 inches thick. It is loam or silt loam. Some pedons lack an A12 horizon. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6 moist, and chroma of 1 to 4.

Harriet series

The Harriet series consists of deep, poorly drained soils formed in clayey alluvium. Permeability is slow. These soils are on bottom land. Slopes are 0 to 1 percent.

Harriet soils commonly are near Egas and Ranslo soils and are similar to Heil and Hurley soils. Carbonates are leached to a greater depth in the Heil soils than in the Harriet soils. Hurley soils are moderately well drained. Egas soils lack a natric horizon. Ranslo soils have a thicker A1 horizon than Harriet soils and are somewhat poorly drained.

Typical pedon of Harriet silt loam, 2,580 feet north and 244 feet west of the southeast corner of sec. 8, T. 127 N., R. 77 W.

A2—0 to 2 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak very thin platy structure; soft, very friable; moderately alkaline; abrupt wavy boundary.

B21t—2 to 7 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; strong medium columnar structure parting to moderate fine subangular blocky; hard, firm, sticky and plastic; gray (10YR 5/1) coatings on tops of columns; strongly alkaline; gradual wavy boundary.

B22t—7 to 14 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, firm, sticky and plastic; few fine nests of salts; strongly alkaline; gradual wavy boundary.

C1gcs—14 to 18 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; weak coarse blocky structure parting to weak very fine subangular blocky; hard, firm, sticky and plastic; common fine nests of salts; strong effervescence; strongly alkaline; clear wavy boundary.

C2g—18 to 29 inches; light gray (5Y 6/1) silty clay, dark gray (5Y 4/1) moist; weak fine and medium subangular blocky structure; hard, firm, sticky and plastic; strong effervescence; strongly alkaline; clear wavy boundary.

C3g—29 to 50 inches; light gray (5Y 6/1) silty clay, dark gray (5Y 4/1) moist; massive; very hard, firm, sticky and plastic; common fine nests and accumulations of salts and carbonate; violent effervescence; strongly alkaline; clear wavy boundary.

C4g—50 to 60 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; common fine distinct mottles, dark brown (7.5YR 4/2) moist, and few fine faint mottles, yellowish brown (10YR 5/6) moist; massive; very hard, firm, sticky and plastic; violent effervescence; strongly alkaline.

The solum ranges from 10 to 22 inches in thickness. Salts typically are at a depth of 4 to 11 inches and in places are throughout the soil.

Some pedons have an A1 horizon, which is 1 to 2 inches thick. The A2 horizon has hue of 10YR or 2.5Y and value of 5 or 6 (3 or 4 moist). It is silt loam or loam and is 1 to 4 inches thick. The B2 horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It may average as low as 35 percent clay and as high as 50 percent clay. Some pedons have a B3 horizon. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 7 (3 to 5 moist), and chroma of 1 to 3. It typically is silty clay but in some pedons is loam, clay loam, or silty clay loam.

Hecla series

The Hecla series consists of deep, moderately well drained soils formed in reworked outwash sands. Permeability is rapid. These soils are on uplands. Slopes range from 0 to 3 percent.

Hecla soils commonly are near Maddock, Tally, and Yecross soils. Maddock and Tally soils are well drained, and Yecross soils are excessively drained. In addition, Tally soils are coarse-loamy.

Typical pedon of Hecla loamy sand, 1,075 feet south and 231 feet east of the northwest corner of sec. 34, T. 125 N., R. 76 W.

A11—0 to 6 inches; dark gray (10YR 4/1) loamy sand, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak medium granular; soft, very friable; neutral; clear smooth boundary.

A12—6 to 16 inches; dark gray (10YR 4/1) loamy sand, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak medium granular; soft, very friable; neutral; clear smooth boundary.

AC—16 to 23 inches; dark grayish brown (10YR 4/2) loamy sand, very dark grayish brown (10YR 3/2) moist; common fine distinct mottles, yellowish brown (10YR 5/6) moist; weak medium subangular blocky structure and single grained; soft, very friable; neutral; gradual smooth boundary.

C1—23 to 35 inches; grayish brown (2.5Y 5/2) fine sand and sand, dark grayish brown (2.5Y 4/2) moist; common fine faint mottles, dark brown (10YR 3/3) moist; single grained; loose; few iron and manganese concentrations; slight effervescence; mildly alkaline; clear wavy boundary.

C2—35 to 60 inches; light olive brown (2.5Y 5/4) fine sand, olive brown (2.5Y 4/4) moist; common fine and medium distinct mottles, dark brown (7.5YR 4/4) moist; single grained; loose; few iron and manganese concentrations; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 16 to 36 inches. The depth to free carbonates ranges from 20 to 45 inches. The mollic epipedon is 10 to 20 inches thick.

The A1 horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2 and is loamy sand, loamy fine sand, sandy loam, or fine sandy loam. It is slightly acid or neutral and is 16 to 28 inches thick. Some pedons lack an AC horizon. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 7 (3 to 5 moist), and chroma of 2 to 4. It is neutral or mildly alkaline.

Heil series

The Heil series consists of deep, poorly drained soils formed in alluvium. Permeability is very slow. These soils are in closed depressions in the uplands. Slopes are 0 to 1 percent.

Heil soils commonly are near Parnell, Tonka, and Williams soils and are similar to Harriet soils. Carbonates are leached to a greater depth in the Heil soils than in Harriet soils. Parnell and Tonka soils have a thicker A1 horizon than Heil soils. Williams soils are well drained and lack a natric horizon.

Typical pedon of Heil silt loam, 1,400 feet west and 140 feet south of the northeast corner of sec. 30, T. 127 N., R. 76 W.

A2—0 inches to 1 inch; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak very thin platy

and weak fine granular structure; soft, very friable; neutral; abrupt wavy boundary.

B21t—1 to 5 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium and coarse columnar structure parting to strong medium blocky; extremely hard, very firm, sticky and plastic; thin gray (10YR 5/1) coatings on top of columns; shiny films on faces of peds; mildly alkaline; clear wavy boundary.

B22t—5 to 17 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate coarse prismatic structure parting to strong coarse blocky; extremely hard, very firm, sticky and plastic; shiny films on faces of peds; moderately alkaline; clear wavy boundary.

B3—17 to 22 inches; dark gray (N 4/0) silty clay, very dark gray (N 3/0) moist; weak medium and coarse subangular blocky structure; extremely hard, very firm, sticky and plastic; slight effervescence; moderately alkaline; clear wavy boundary.

C1gcs—22 to 31 inches; dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; weak coarse subangular blocky structure; extremely hard, very firm, sticky and plastic; common fine nests of salts; slight effervescence; moderately alkaline; gradual wavy boundary.

C2g—31 to 42 inches; dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; few fine faint mottles, yellowish brown (10YR 5/6) moist; massive; extremely hard, very firm, sticky and plastic; few fine nests of salts; slight effervescence; strongly alkaline; gradual wavy boundary.

C3g—42 to 60 inches; gray (5Y 5/1) silty clay, dark gray (5Y 4/1) moist; massive; extremely hard, very firm, sticky and plastic; strong effervescence; strongly alkaline.

The thickness of the solum ranges from 10 to 40 inches. The depth to free carbonates ranges from 15 to 36 inches. Exchangeable sodium is more than 15 percent in some part of the B or C horizon.

Some pedons have an A1 horizon, which is 1 to 3 inches thick. The A2 horizon has hue of 10YR, 2.5Y, or 5Y and value of 5 or 6 (3 to 5 moist). It is silt loam or silty clay loam and is 1 to 4 inches thick. The B2t horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5 (3 or 4 moist), and chroma of 1 or 2. It may average as low as 45 percent clay and as high as 55 percent clay. The C horizon typically is silty clay but in some pedons is clay or clay loam.

Hurley series

The Hurley series consists of deep or moderately deep, moderately well drained soils on uplands. Permeability is very slow. These soils formed in material weathered from shale. Slopes range from 0 to 6 percent.

Hurley soils commonly are near Opal and Promise soils and are similar to Harriet soils. Harriet soils are poorly drained. Opal and Promise soils lack a natric horizon and are well drained.

Typical pedon of Hurley silt loam, 0 to 6 percent slopes, 200 feet east and 300 feet south of the northwest corner of sec. 3, T. 127 N., R. 78 W.

A2—0 to 2 inches; light brownish gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak very thin platy structure parting to weak fine granular; slightly hard, friable; neutral; abrupt smooth boundary.

B2t—2 to 7 inches; grayish brown (10YR 5/2) clay, very dark gray (10YR 3/1) moist; moderate medium columnar structure parting to moderate fine and medium blocky; extremely hard, extremely firm, sticky and plastic; light gray (10YR 6/1) coatings on tops of columns; mildly alkaline; gradual smooth boundary.

B3—7 to 11 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate fine and medium blocky; very hard, very firm, sticky and plastic; slight effervescence; moderately alkaline; clear wavy boundary.

C1cacs—11 to 17 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky structure; hard, firm, sticky and plastic; many fine and medium nests of salts and gypsum; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—17 to 25 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and plastic; few fine nests of salts and gypsum; slight effervescence; moderately alkaline; gradual smooth boundary.

C3—25 to 60 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and plastic; few fine nests of salts and gypsum; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 9 to 20 inches. The depth to free carbonates is 5 to 12 inches. Salts are above or in horizons containing free carbonates. Exchangeable sodium is more than 15 percent in some part of the B horizon within a depth of 16 inches. The depth to shale ranges from 24 to more than 60 inches.

Some pedons have an A1 horizon, which is 1 to 3 inches thick. The A2 horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 1 or 2. It is silt loam or silty clay loam and is slightly acid or neutral. The thickness of the A1 horizon combined with that of the A2 horizon is 5 inches or less. The B2t horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It

may average as low as 60 percent clay and as high as 70 percent clay.

Lehr series

The Lehr series consists of somewhat excessively drained soils that are shallow over sand and gravel. These soils are moderately rapidly permeable through the solum and rapidly permeable in the underlying sand and gravel. They formed in loamy sediments overlying glacial outwash material. They are on upland terraces. Slopes range from 0 to 15 percent.

Lehr soils are similar to and commonly are near Bowdle and Wabek soils. Bowdle soils have sand and gravel below a depth of 20 inches. Wabek soils are excessively drained and are shallower to sand and gravel than Lehr soils.

Typical pedon of Lehr loam, 3 to 6 percent slopes, 387 feet north and 117 feet east of the southwest corner of sec. 28, T. 125 N., R. 75 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

B2—5 to 14 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; neutral; gradual smooth boundary.

B3ca—14 to 17 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; moderate fine prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable; common fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

IIC—17 to 60 inches; varicolored sand and gravel; single grained; loose; thin coatings of carbonate on undersides of pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 15 to 20 inches and is the same as the depth to gravelly material. Reaction ranges from neutral in the upper horizons to moderately alkaline in the lower horizons.

The A horizon has value of 4 or 5 and is 5 to 8 inches thick. It commonly is loam but in some pedons is silt loam or sandy loam. The B2 horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. It is loam or clay loam. The B horizon may average as low as 18 percent clay and as high as 28 percent clay.

Lihen series

The Lihen series consists of deep, well drained soils formed in material weathered from soft sandstone. Permeability is rapid. These soils are on uplands. Slopes range from 9 to 20 percent.

Lihen soils commonly are near Flasher and Opal soils and are similar to Maddock soils. Flasher soils lack a mollic epipedon. Maddock soils have a cambic horizon. Opal soils have shale below a depth of 20 inches and have a finer textured subsoil than Lihen soils.

Typical pedon of Lihen loamy fine sand, 9 to 20 percent slopes, 1,450 feet east and 440 feet north of the southwest corner of sec. 14, T. 128 N., R. 79 W.

A11—0 to 8 inches; brown (10YR 4/3) loamy fine sand, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable; neutral; gradual wavy boundary.

A12—8 to 15 inches; brown (10YR 4/3) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to single grained; soft, very friable; mildly alkaline; gradual smooth boundary.

AC—15 to 20 inches; brown (10YR 4/3) loamy fine sand, very dark grayish brown (10YR 3/2) moist; single grained; soft, very friable; strong effervescence; mildly alkaline; gradual smooth boundary.

C1ca—20 to 32 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) moist; single grained; loose; few fine streaks and accumulations of carbonate; violent effervescence; mildly alkaline; gradual smooth boundary.

C2ca—32 to 60 inches; light olive brown (2.5Y 5/4) fine sandy loam, olive brown (2.5Y 4/4) moist; single grained; loose; common fine accumulations of carbonate; violent effervescence; moderately alkaline.

The thickness of solum ranges from 10 to 30 inches. The depth to free carbonates ranges from 10 to more than 30 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is loamy fine sand, fine sandy loam, or loamy sand. The C horizon has value of 4 to 7 (3 to 5 moist) and chroma of 2 to 4. It is fine sandy loam, sandy loam, loamy fine sand, or fine sand.

Linton series

The Linton series consists of deep, well drained soils formed in silty loess. Permeability is moderate. These soils are on terraces and uplands. Slopes range from 0 to 15 percent.

Linton soils are similar to Bryant soils and are near Grassna and Sutley soils. Bryant soils are fine-silty. Grassna soils have a mollic epipedon that is more than 16 inches thick. Sutley soils lack a cambic horizon and are calcareous near the surface.

Typical pedon of Linton silt loam, 3 to 6 percent slopes, 2,340 feet south and 335 feet west of the northeast corner of sec. 11, T. 128 N., R. 79 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

B21—7 to 13 inches; brown (10YR 4/3) silt loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable; neutral; gradual smooth boundary.

B22—13 to 18 inches; brown (10YR 5/3) silt loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable; mildly alkaline; gradual smooth boundary.

B23—18 to 21 inches; grayish brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse prismatic structure parting to moderate coarse subangular blocky; hard, friable; mildly alkaline; clear smooth boundary.

B3ca—21 to 29 inches; light brownish gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

C—29 to 60 inches; light brownish gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; massive; hard, friable; common fine accumulations and threads of carbonate; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 18 to 38 inches. The depth to free carbonates ranges from 10 to 28 inches. The mollic epipedon is 7 to 15 inches thick.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 to 3 (2 or 3 moist). It is 6 to 10 inches thick. The B2 horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 2 or 3. It averages less than 18 percent clay. Some pedons lack a B3 horizon. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4.

Maddock series

The Maddock series consists of deep, well drained soils formed in fine sands deposited by wind or water. Permeability is rapid. These soils are on uplands. Slopes range from 0 to 12 percent.

Maddock soils commonly are near Hecla, Tally, Wyndmere, and Yecross soils and are similar to Lihen soils. Hecla soils are moderately well drained and have carbonates below a depth of 20 inches. Lihen soils lack a cambic horizon. Tally soils are coarse-loamy. Wyndmere soils are coarse-loamy and have a calcic horizon. Yecross soils are excessively drained.

Typical pedon of Maddock loamy fine sand, 0 to 6 percent slopes, 2,226 feet west and 222 feet south of the northeast corner of sec. 16, T. 125 N., R. 76 W.

A1—0 to 15 inches; very dark gray (10YR 3/1) loamy fine sand, black (10YR 2/1) moist; weak fine granular structure; loose; slightly acid; gradual smooth boundary.

B2—15 to 28 inches; dark grayish brown (10YR 4/2) fine sand, very dark grayish brown (10YR 3/2) moist; single grained; loose; slightly acid; gradual smooth boundary.

C1—28 to 53 inches; brown (10YR 4/3) fine sand, dark brown (10YR 3/3) moist; single grained; loose; neutral; gradual smooth boundary.

C2—53 to 60 inches; grayish brown (2.5Y 5/2) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; single grained; loose; strong effervescence; mildly alkaline.

The depth to free carbonates is 10 inches or more, and reaction ranges from slightly acid to moderately alkaline throughout the profile. The control section is fine sand, loamy fine sand, or loamy sand; the content of sand and coarse sand is less than 50 percent. The mollic epipedon is 10 to 15 inches thick. A small amount of fine gravel is in some pedons.

The A horizon has value of 3 to 5 (2 or 3 moist). It is loamy fine sand, fine sandy loam, sandy loam, or loamy sand. It is 7 to 15 inches thick. The B horizon has value of 4 to 6 (2 to 5 moist) and chroma of 2 to 4. The C horizon has value of 4 to 7 (3 to 6 moist) and chroma of 2 to 4.

Noonan series

The Noonan series consists of deep, moderately well drained soils formed in glacial till. Permeability is slow. These soils have a claypan subsoil. They are on uplands. Slopes range from 0 to 4 percent.

The Noonan soils in Campbell County contain more clay than is defined as the range for the series. This difference, however, does not alter the use or behavior of these soils.

Noonan soils commonly are near Bowbells, Tonka, and Williams soils. Bowbells and Williams soils lack a natric horizon. Tonka soils are poorly drained and are in closed depressions.

Typical pedon of Noonan loam in an area of Williams-Noonan loams, 0 to 4 percent slopes, 33 feet north and 2,617 feet west of the southeast corner of sec. 1, T. 128 N., R. 75 W.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure parting to mod-

erate very thin platy; slightly hard, very friable; neutral; clear smooth boundary.

A2—6 to 9 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; neutral; abrupt smooth boundary.

B21t—9 to 12 inches; dark brown (10YR 4/3) clay loam, very dark grayish brown (10YR 3/2) moist; grayish brown (10YR 5/2) coatings on top of columns; strong fine and medium columnar structure parting to strong fine and medium blocky; very hard, very firm, sticky and plastic; shiny films on faces of peds; mildly alkaline; clear smooth boundary.

B22t—12 to 15 inches; dark brown (10YR 4/3) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium blocky; very hard, very firm, sticky and plastic; shiny films on faces of peds; moderately alkaline; gradual smooth boundary.

B3—15 to 19 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; few fine accumulations of carbonate and nests of salts; slight effervescence; moderately alkaline; clear smooth boundary.

C1cacs—19 to 31 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; common medium accumulations of carbonate and nests of salts; violent effervescence; moderately alkaline; clear smooth boundary.

C2—31 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and plastic; few fine and medium accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 14 to 28 inches, and the depth to free carbonates ranges from 8 to 20 inches.

The A1 horizon has value of 3 to 5 (2 or 3 moist) and chroma of 2 or 3. It is loam or silt loam and is 3 to 6 inches thick. The A2 horizon has hue of 10YR or 2.5Y, value of 5 to 7 (3 to 5 moist), and chroma of 1 or 2. It is loam or silt loam and is 1 to 4 inches thick. The A horizon is slightly acid or neutral. The B2t horizon has hue of 10YR or 2.5Y, value of 4 to 6 (2 or 3 moist), and chroma of 2 or 3. It ranges from neutral to moderately alkaline. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is loam or clay loam and is moderately alkaline or strongly alkaline.

Opal series

The Opal series consists of moderately deep, well drained soils formed in material weathered from shale. Permeability is very slow. These soils are on uplands. Slopes range from 3 to 25 percent.

Opal soils commonly are near Hurley, Promise, and Sansarc soils. Hurley soils have a natric horizon. Promise soils do not have shale within a depth of 40 inches. Sansarc soils have shale within a depth of 20 inches.

Typical pedon of Opal clay, in an area of Opal-Sansarc clays, 6 to 15 percent slopes, 200 feet west and 2,170 feet south of the northeast corner of sec. 4, T. 127 N., R. 78 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) clay, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak very fine granular; hard, firm, sticky and plastic; neutral; clear wavy boundary.

B2—5 to 15 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse prismatic structure parting to moderate medium subangular blocky; very hard, very firm, sticky and plastic; slight effervescence; mildly alkaline; gradual wavy boundary.

B3—15 to 22 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure parting to weak medium subangular blocky; very hard, very firm, sticky and plastic; slight effervescence; mildly alkaline; gradual wavy boundary.

C1ca—22 to 25 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; hard, firm, sticky and plastic; few fine accumulations of carbonate; slight effervescence; mildly alkaline; clear wavy boundary.

C2—25 to 31 inches; light brownish gray (2.5Y 6/2) shaly clay, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and plastic; 60 to 70 percent shale fragments; few fine nests of gypsum crystals; slight effervescence; mildly alkaline; clear wavy boundary.

Cr—31 to 60 inches; gray (5Y 6/1) soft shale, dark gray (5Y 4/1) moist; shale plates are very hard and brittle when dry; common fine iron stains in seams; neutral.

The thickness of the solum ranges from 12 to 26 inches. Free carbonates are throughout all parts of the soil but the upper few inches. The depth to shale ranges from 20 to 40 inches. The control section averages more than 60 percent clay. When the soil is dry, cracks as much as 1 inch wide and several feet long are common. Crystals of gypsum and nests of salts are in seams in the shale. The mollic epipedon is 7 to 10 inches thick.

The A horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is 4 to 8 inches thick and is neutral or mildly alkaline. The B2 horizon has hue of 2.5Y or 5Y, value of 4 to 6 (2 to 4 moist), and chroma of 1 to 3. It is mildly alkaline or moderately alkaline. The C horizon has value of 5 or 6 (4 or 5 moist) and chroma of 1 to 3. It is neutral to moderately alkaline.

Parnell series

The Parnell series consists of deep, very poorly drained soils formed in alluvial material. Permeability is slow. These soils are in closed depressions in the uplands. Slopes are 0 to 1 percent.

Parnell soils commonly are near Bowbells and Williams soils and are similar to Tonka soils. Bowbells and Williams soils are fine-loamy. Tonka soils are poorly drained.

Typical pedon of Parnell silty clay loam, 150 feet south and 200 feet east of the northwest corner of sec. 1, T. 126 N., R. 75 W.

A1—0 to 16 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; common fine and medium distinct stains, olive (5Y 5/4) moist; moderate medium subangular blocky structure parting to moderate fine and medium granular; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.

B21t—16 to 25 inches; gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; mildly alkaline; gradual smooth boundary.

B22tg—25 to 48 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; mildly alkaline; gradual smooth boundary.

Cgca—48 to 60 inches; gray (5Y 5/1) silty clay, dark gray (5Y 4/1) moist; few fine faint mottles, olive (5Y 5/6) moist; weak medium and coarse subangular blocky structure; hard, firm, sticky and plastic; common medium accumulations of carbonate; few fine nests of salts; strong effervescence; moderately alkaline.

The A1 horizon is silty clay loam, silty clay, or silt loam. It is slightly acid to mildly alkaline and is 6 to 18 inches thick. Some pedons have an A12 horizon, which is as much as 10 inches thick. The B horizon has hue of 10YR, 2.5Y, or 5Y, value of 2 to 4 moist, and chroma of 1 or 2. It is silty clay loam, silty clay, clay loam, or clay. It may average as low as 35 percent clay and as high as 50 percent clay. It is slightly acid to mildly alkaline. The C horizon has hue of 2.5Y or 5Y, value of 3 to 6 moist, and chroma of 1 or 2. It is neutral to moderately alkaline.

Parshall series

The Parshall series consists of deep, well drained soils formed in glacial outwash or wind-deposited material. Permeability is moderately rapid. These soils are on outwash plains and on uplands. Slopes range from 0 to 3 percent.

Parshall soils commonly are near Maddock, Tally, and Yecross soils. Maddock and Yecross soils are sandy, and Tally soils have a mollic epipedon that is less than 16 inches thick.

Typical pedon of Parshall fine sandy loam, 219 feet east and 96 feet north of the southwest corner of sec. 29, T. 128 N., R. 77 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; soft, very friable; neutral; abrupt smooth boundary.

A12—8 to 11 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to moderate medium and coarse subangular blocky; soft, very friable; neutral; gradual smooth boundary.

B21—11 to 23 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium and coarse subangular blocky; slightly hard, very friable; neutral; gradual wavy boundary.

B22—23 to 35 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine and medium prismatic structure parting to weak medium subangular blocky; soft, very friable; neutral; gradual wavy boundary.

C1ca—35 to 50 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; many fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—50 to 60 inches; light brownish gray (10YR 6/2) loamy fine sand, grayish brown (10YR 5/2) moist; massive; soft, very friable; few fine accumulations of carbonate; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 18 to 45 inches and the depth to free carbonates from 24 to 50 inches. The mollic epipedon is more than 16 inches thick.

The A horizon has value of 2 or 3 moist. It is fine sandy loam, loam, or sandy loam. It is 8 to 20 inches thick. The B2 horizon has value of 2 or 3 moist and chroma of 2 to 4. The C horizon is fine sandy loam, sandy loam, loamy fine sand, or loamy sand.

Promise series

The Promise series consists of deep, well drained soils formed in material weathered from shale. Permeability is slow. These soils are on uplands. Slopes range from 0 to 9 percent.

In the Promise soils in Campbell County, free carbonates are leached to a greater depth than is defined as the range for the series. This difference, however, does not alter the use or behavior of the soils.

Promise soils commonly are near Hurley and Opal soils. Hurley soils have a natric horizon. Opal soils have shale within a depth of 20 to 40 inches.

Typical pedon of Promise clay, 3 to 6 percent slopes, 2,520 feet south and 51 feet east of the northwest corner of sec. 28, T. 128 N., R. 78 W.

Ap—0 to 6 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; moderate fine and medium subangular blocky structure parting to moderate fine granular; very hard, firm, sticky and plastic; neutral; abrupt smooth boundary.

B2—6 to 16 inches; dark gray (5Y 4/1) clay, black (5Y 2/1) moist; moderate medium prismatic structure parting to moderate medium and coarse subangular blocky; extremely hard, firm, sticky and plastic; mildly alkaline; gradual wavy boundary.

B3ca—16 to 24 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; moderate coarse subangular blocky structure; extremely hard, firm, sticky and plastic; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C1cacs—24 to 29 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; moderate medium and coarse subangular blocky structure; extremely hard, firm, sticky and plastic; common fine accumulations of carbonate and nests of gypsum; strong effervescence; moderately alkaline; gradual wavy boundary.

C2cs—29 to 40 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; few fine distinct mottles, dark yellowish brown (10YR 4/6) moist; massive; extremely hard, firm, sticky and plastic; common fine nests of salts and gypsum; strong effervescence; moderately alkaline; gradual wavy boundary.

C3—40 to 60 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; massive; extremely hard, firm, sticky to plastic; few fine nests of salts; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 30 inches. Shale is within a depth of 40 to 60 inches in some pedons. The control section ranges from 60 to 65 percent clay. When the soil is dry, cracks as much as 1 inch wide and several feet long are common. The mollic epipedon is 7 to 16 inches thick.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is 5 to 10 inches thick. It is neutral or mildly alkaline. The B horizon has hue of 2.5Y or 5Y, value of 4 to 6 (2 to 4 moist), and chroma of 1 to 3. It is mildly alkaline or moderately alkaline. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is moderately alkaline or strongly alkaline. It has few or common nests of gypsum or salts.

Ranslo series

The Ranslo series consists of deep, somewhat poorly drained soils formed in loamy and clayey alluvium. Permeability is slow. These soils are on terraces and bottom land. Slopes range from 0 to 2 percent.

Ranslo soils commonly are near Farnuf, Harriet, and Straw soils. Farnuf soils are well drained and lack a natric horizon. Harriet soils have an A horizon that is less than 5 inches thick. Straw soils are well drained and are fine-loamy.

Typical pedon of Ranslo silt loam, in an area of Ranslo-Harriet silt loams, 1,950 feet south and 65 feet west of the northeast corner of sec. 18, T. 128 N., R. 77 W.

Ap—0 to 6 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak medium granular; slightly hard, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

A12—6 to 8 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B&A—8 to 12 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 4/1) moist (B); gray (10YR 5/1) silt loam, dark gray (10YR 3/1) moist (A); moderate very fine and fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B21t—12 to 18 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm, sticky and plastic; neutral; clear wavy boundary.

B22t—18 to 24 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to moderate medium and coarse subangular blocky; very hard, firm, sticky and plastic; mildly alkaline; clear wavy boundary.

B23t—24 to 34 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; few fine

accumulations of carbonate; slight effervescence; moderately alkaline; gradual wavy boundary.

Cca—34 to 60 inches; olive gray (5Y 5/2) silty clay loam, olive gray (5Y 4/2) moist; massive; very hard, firm, sticky and plastic; many fine accumulations of carbonate and nests of salts; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 36 inches and the depth to free carbonates from 12 to 25 inches.

The A1 horizon has value of 4 or 5 (2 or 3 moist). It is silt loam or silty clay loam. Some pedons have an A2 horizon. The B21t horizon has hue of 10YR or 2.5Y and value of 3 to 5 (2 or 3 moist). The B22t and B23t horizons have hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 1 or 2. The B2t horizon may average as low as 35 percent clay and as high as 45 percent clay. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 or 2. It is clay loam, silty clay loam, silty clay, or clay.

Regan series

The Regan series consists of deep, very poorly drained soils formed in alluvium. Permeability is moderate. These soils are in drainageways on bottom land. Slopes are less than 1 percent.

Regan soils commonly are near Harriet, Parnell, and Vallers soils and are similar to Arveson and Wyndmere soils. Arveson and Wyndmere soils are coarse-loamy. Harriet soils have a natric horizon. Parnell soils have a finer textured subsoil than Regan soils. Vallers soils are fine-loamy.

Typical pedon of Regan silt loam, 1,056 feet south and 123 feet east of the northwest corner of sec. 32, T. 125 N., R. 75 W.

A11—0 to 3 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, friable; slight effervescence; mildly alkaline; clear smooth boundary.

A12—3 to 10 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak fine subangular blocky structure parting to weak medium granular; slightly hard, friable; strong effervescence; mildly alkaline; clear smooth boundary.

ACca—10 to 15 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak fine subangular blocky structure; slightly hard, friable; violent effervescence; mildly alkaline; clear wavy boundary.

C1ca—15 to 30 inches; gray (5Y 6/1) silt loam, dark gray (5Y 4/1) moist; weak fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; mildly alkaline; clear wavy boundary.

C2g—30 to 60 inches; gray (5Y 5/1) silty clay loam, dark gray (5Y 4/1) moist; common fine faint mottles, yellowish brown (10YR 5/6) moist; massive; extremely hard, firm, sticky and plastic; violent effervescence; mildly alkaline.

The control section may average as low as 28 percent clay and as high as 35 percent clay. Reaction ranges from mildly alkaline in the upper horizons to strongly alkaline in the lower horizons. The calcium carbonate equivalent ranges from 16 to 34 percent in some part of the soil within a depth of 15 inches. The mollic epipedon is 7 to 16 inches thick.

The A1 horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is silt loam, silty clay loam, or clay loam and is 5 to 12 inches thick. Some pedons lack an AC horizon. The Cca horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 7 (3 to 5 moist), and chroma of 1 or 2.

Sansarc series

The Sansarc series consists of shallow, well drained soils formed in material weathered from clayey shale. Permeability is slow. These soils are on uplands. Slopes range from 6 to 40 percent.

Sansarc soils commonly are near Hurley, Opal, and Promise soils. Hurley soils have a natric horizon. Opal and Promise soils have shale below a depth of 20 inches.

Typical pedon of Sansarc clay, in an area of Opal-Sansarc clays, 6 to 15 percent slopes, 3,006 feet west and 2,004 feet north of the southeast corner of sec. 4, T. 126 N., R. 78 W.

A1—0 to 4 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure parting to weak very fine granular; hard, firm, sticky and plastic; slight effervescence; mildly alkaline; gradual wavy boundary.

C1—4 to 7 inches; grayish brown (2.5Y 5/2) shaly clay, dark grayish brown (2.5Y 4/2) moist; weak moderate subangular blocky structure parting to weak fine granular; hard, firm, sticky and plastic; about 20 percent fine shale fragments; slight effervescence; mildly alkaline; gradual wavy boundary.

C2—7 to 11 inches; grayish brown (2.5Y 5/2) shaly clay, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, firm, sticky and plastic; about 55 percent fine shale fragments; common medium distinct yellowish brown (10YR 5/6) stains; slight effervescence; mildly alkaline; clear wavy boundary.

Cr—11 to 60 inches; dark gray (5Y 4/1) shale, very dark gray (5Y 3/1) moist; few coarse distinct yellowish brown (10YR 5/6) stains; shale plates are hard and brittle when dry; slight effervescence; mildly alkaline.

The depth to shale ranges from 4 to 20 inches. The horizons above the shale may average as low as 55 percent clay and as high as 60 percent clay.

The A1 horizon has hue of 10YR, 2.5Y, or 5Y and value of 5 to 7 (3 to 5 moist). It is clay or shaly clay. It is mildly alkaline or moderately alkaline and is 2 to 4 inches thick. The C horizon has hue of 10YR, 2.5Y, or 5Y and ranges from slightly acid to moderately alkaline.

Savage series

The Savage series consists of deep, well drained soils formed in alluvium. Permeability is moderately slow. These soils are on terraces. Slopes range from 0 to 6 percent.

Savage soils commonly are near Farnuf and Grail soils. Farnuf soils are fine-loamy. Grail soils have a mollic epipedon that is more than 16 inches thick.

Typical pedon of Savage silt loam, 0 to 3 percent slopes, 2,505 feet west and 870 feet north of the southeast corner of sec. 4, T. 128 N., R. 78 W.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

B21t—3 to 5 inches; dark grayish brown (2.5Y 4/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; hard, firm, sticky and plastic; shiny films on faces of peds; mildly alkaline; clear wavy boundary.

B22t—5 to 15 inches; dark grayish brown (2.5Y 4/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; shiny films on faces of peds; mildly alkaline; gradual wavy boundary.

B3ca—15 to 20 inches; grayish brown (2.5Y 5/2) and very pale brown (10YR 7/4) silty clay, dark grayish brown (2.5Y 4/2) and brown (10YR 5/3) moist; weak coarse prismatic structure parting to moderate coarse subangular blocky; very hard, firm, sticky and plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C1ca—20 to 25 inches; light yellowish brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; weak coarse subangular blocky structure; hard, firm, sticky and plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—25 to 34 inches; light yellowish brown (2.5Y 6/4) silty clay loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence; mildly alkaline; gradual wavy boundary.

C3—34 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 19 to 28 inches. The mollic epipedon is less than 16 inches thick.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is 2 to 6 inches thick. The B2 horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. It is silty clay loam or silty clay. It may average as low as 35 percent clay and as high as 45 percent clay. The C horizon has hue of 10YR or 2.5Y.

Seroco series

The Seroco series consists of deep, excessively drained soils formed in wind- and water-sorted sandy material. Permeability is rapid. These soils are on outwash plains and uplands. Slopes range from 2 to 25 percent.

Seroco soils commonly are near Maddock and Tally soils and are similar to Yecross soils. Maddock and Tally soils have a mollic epipedon. In addition, Tally soils are coarse-loamy. Yecross soils are underlain by sand and gravelly sand.

Typical pedon of Seroco loamy fine sand, 2 to 15 percent slopes, 2,240 feet west and 129 feet south of the northeast corner of sec. 27, T. 125 N., R. 76 W.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; single grained; loose; many fine and medium roots; neutral; clear wavy boundary.

C1—3 to 18 inches; brown (10YR 5/3) fine sand, dark brown (10YR 4/3) moist; very weak medium subangular blocky structure parting to single grained; loose; many fine roots; neutral; clear wavy boundary.

C2—18 to 60 inches; brown (10YR 5/3) fine sand, dark brown (10YR 4/3) moist; single grained; loose; neutral.

The depth to free carbonates typically is more than 60 inches but ranges from 35 to more than 60 inches. Reaction ranges from slightly acid in the upper horizons to mildly alkaline in the lower horizons. Some pedons have thin dark layers and more variations in texture. The control section is loamy fine sand, loamy sand, or fine sand.

The A horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. It is loamy fine sand or fine sand. It is 2 to 6 inches thick. Some pedons have an AC horizon. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. In some pedons, material that is finer or coarser textured than fine sand is below a depth of 40 inches.

Straw series

The Straw series consists of deep, well drained soils formed in alluvial material. Permeability is moderate. These soils are on channeled stream bottoms. Slopes range from 0 to 2 percent.

In the Straw soils in Campbell County, the A horizon has a lower chroma, the mollic epipedon is thicker, and carbonates are leached to a greater depth than is defined as the range for the series. These differences, however, do not alter the use or behavior of these soils.

Straw soils commonly are near Farnuf, Harriet, and Ranslo soils. Farnuf soils have an argillic horizon. Harriet and Ranslo soils have a natric horizon.

Typical pedon of Straw loam, channeled, 375 feet east and 165 feet south of the northwest corner of sec. 4, T. 127 N., R. 75 W.

A11—0 to 5 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; moderate fine granular structure; slightly hard, friable; neutral; clear smooth boundary.

A12—5 to 23 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; neutral; clear smooth boundary.

C1ca—23 to 41 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; massive; slightly hard, friable; common fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

C2—41 to 49 inches; dark grayish brown (2.5Y 4/2) sandy loam, very dark grayish brown (2.5Y 3/2) moist; massive; slightly hard, friable; 20 percent coarse fragments by volume; strong effervescence; mildly alkaline; clear smooth boundary.

C3—49 to 55 inches; dark grayish brown (2.5Y 4/2) loam, very dark grayish brown (2.5Y 3/2) moist; massive; slightly hard, friable; common fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

C4—55 to 60 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; massive; hard, firm, slightly sticky and slightly plastic; common fine and medium accumulations of carbonate; violent effervescence; mildly alkaline.

The mollic epipedon typically is 40 inches or more thick but ranges from 16 to 60 inches. The depth to free carbonates ranges from 7 to 25 inches. Some pedons have a buried A horizon, nests of salts, or thin lenses of clay or loamy sand.

The A horizon has hue of 10YR or 2.5Y and value of 3 to 5 (2 or 3 moist). It is loam, silt loam, or clay loam and is 20 to 30 inches thick. The C horizon has hue of 10YR or 2.5Y.

Sully series

The Sully series consists of deep, well drained soils. Permeability is moderate. These soils formed in calcareous loess on uplands. Slopes range from 9 to 40 percent.

Sully soils commonly are near Linton and Sutley soils, both of which have a mollic epipedon.

Typical pedon of Sully silt loam, 9 to 25 percent slopes, 1,400 feet south and 70 feet west of the northeast corner of sec. 27, T. 128 N., R. 79 W.

A1—0 to 3 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; soft, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

C1ca—3 to 13 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; violent effervescence; moderately alkaline; gradual smooth boundary.

C2—13 to 60 inches; light brownish gray (10YR 6/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

The depth to free carbonates is less than 5 inches. The control section is silt loam or very fine sandy loam. Its clay content is less than 18 percent.

The A horizon has value of 4 or 5 (3 or 4 moist) and chroma of 2 or 3. It is silt loam or very fine sandy loam and is 2 to 5 inches thick. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4.

Sutley series

The Sutley series consists of deep, well drained soils. Permeability is moderate. These soils formed in calcareous silty glacial drift or loess on uplands. Slopes range from 2 to 15 percent.

Sutley soils commonly are near Bryant, Linton, and Sully soils. Bryant and Linton soils have a cambic horizon. In addition, Bryant soils are fine-silty. Sully soils lack a mollic epipedon.

Typical pedon of Sutley silt loam in an area of Linton-Sutley silt loams, 2 to 6 percent slopes, 1,100 feet south and 160 feet west of the northeast corner of sec. 19, T. 127 N., R. 77 W.

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse subangular blocky structure; slightly hard, friable; many very fine roots and pores; strong ef-

fervescence; mildly alkaline; abrupt smooth boundary.

C1ca—6 to 24 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable; common fine roots and tubular pores; many fine accumulations of carbonate; violent effervescence; moderately alkaline; clear wavy boundary.

C2—24 to 60 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable; few fine accumulations of carbonate; violent effervescence; moderately alkaline.

The depth to free carbonates is less than 8 inches. The l0- to 40-inch control section is silt loam or very fine sandy loam.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is 4 to 8 inches thick. Some pedons have an AC horizon, which is 2 to 4 inches thick. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. Some pedons have shale or glacial till within a depth of 40 to 60 inches.

Tally series

The Tally series consists of deep, well drained soils formed in fine sandy loam outwash that has been reworked and deposited by wind. Permeability is moderately rapid. These soils are on uplands. Slopes range from 0 to 9 percent.

Tally soils commonly are near Maddock, Williams, and Yecross soils and are similar to Parshall soils. Maddock and Yecross soils are sandy, and Williams soils are fine-loamy. Parshall soils are dark colored to a greater depth than Tally soils.

Typical pedon of Tally fine sandy loam, 3 to 6 percent slopes, 1,255 feet south and 90 feet west of the northeast corner of sec. 22, T. 125 N., R. 76 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak medium granular structure; soft, very friable; neutral; abrupt smooth boundary.

B2—7 to 14 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure; slightly hard, very friable; many fine accumulations of carbonate; violent effervescence; mildly alkaline; clear wavy boundary.

C1ca—14 to 31 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; slightly hard, very friable; many fine accumulations of carbonate; violent effervescence; mildly alkaline; clear wavy boundary.

C2—31 to 42 inches; grayish brown (2.5Y 5/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable; few fine accumulations of carbonate; violent effervescence; moderately alkaline; clear smooth boundary.

C3—42 to 60 inches; grayish brown (2.5Y 5/2) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 13 to 19 inches and the depth to free carbonates from 12 to 26 inches. The control section may average as low as 12 percent clay and as high as 18 percent clay. The mollic epipedon is 10 to 15 inches thick.

The A horizon has hue of 10YR, value of 3 or 4 (2 or 3 moist), and chroma of 2 or 3. It is fine sandy loam or sandy loam and is 7 to 10 inches thick. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. It is fine sandy loam or sandy loam. Some pedons have a B3ca horizon. The C horizon is loamy fine sand, fine sandy loam, loamy sand, or fine sand.

Tonka series

The Tonka series consists of deep, poorly drained soils formed in local alluvium. Permeability is slow. These soils are in closed depressions in the uplands. Slopes are 0 to 1 percent.

Tonka soils commonly are near Bryant, Heil, and Williams soils and are similar to Parnell soils. Bryant soils are fine-silty, and Williams soils are fine-loamy. Heil soils have a natric horizon. Parnell soils are very poorly drained.

Typical pedon of Tonka silt loam, 510 feet east and 150 feet south of the northwest corner of sec. 5, T. 126 N., R. 75 W.

A1—0 to 7 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate fine granular and moderate very thin platy structure; slightly hard, friable; neutral; abrupt wavy boundary.

A2—7 to 15 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; many medium prominent mottles, yellowish brown (10YR 5/6) moist; moderate very thin and thin platy and granular structure; slightly hard, friable; neutral; abrupt irregular boundary.

B21t—15 to 23 inches; gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; strong coarse prismatic structure parting to moderate very fine blocky; hard, firm, sticky and plastic; mildly alkaline; gradual wavy boundary.

B22t—23 to 34 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate coarse prismatic structure parting to moderate very

fine blocky; hard, firm, sticky and plastic; mildly alkaline; gradual wavy boundary.

B3—34 to 43 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak coarse subangular blocky structure; hard, firm, sticky and plastic; mildly alkaline; gradual wavy boundary.

Cg—43 to 60 inches; pale olive (5Y 6/3) clay loam, olive (5Y 4/3) moist; many coarse prominent mottles, light olive brown (2.5Y 5/6) moist; massive; hard, firm, sticky and plastic; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 24 to more than 60 inches.

The A1 horizon has hue of 10YR, value of 3 or 4 (2 or 3 moist), and chroma of 1 or is neutral in color. It is silt loam or loam and is 6 to 16 inches thick. The A2 horizon has hue of 10YR or 2.5Y, value of 5 to 7 (3 to 5 moist), and chroma of 1 or 2 or is neutral in color. It is silt loam or loam. It is 4 to 16 inches thick, and it extends into the B2t horizon in some pedons. Some pedons have an A&B horizon. The B horizon has hue of 10YR or 2.5Y, value of 2 to 4 moist, and chroma of 1 or 2. It is clay, silty clay, silty clay loam, or clay loam. It may average as low as 35 percent clay and as high as 45 percent clay.

Vallers series

The Vallers series consists of deep, poorly drained soils formed in alluvial material. Permeability is moderately slow. These soils are on bottom land and in drainageways. Slopes range from 0 to 2 percent.

Vallers soils commonly are near Divide, Regan, and Wyndmere soils and are similar to Arveson soils. Arveson soils are coarse-loamy. Divide soils have sand and gravel within a depth of 40 inches. Regan soils are very poorly drained and are fine-silty. Wyndmere soils are coarse-loamy.

Typical pedon of Vallers loam, 2,170 feet west and 50 feet south of the northeast corner of sec. 28, T. 126 N., R. 76 W.

A11—0 to 6 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak fine and medium subangular blocky structure; soft, very friable; slight effervescence; mildly alkaline; clear smooth boundary.

A12—6 to 9 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak fine and medium subangular blocky structure; soft, friable; slight effervescence; mildly alkaline; clear wavy boundary.

C1ca—9 to 13 inches; white (N 8/0) clay loam, light brownish gray (2.5Y 6/2) moist; moderate medium subangular blocky structure parting to weak fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; clear wavy boundary.

C2gca—13 to 29 inches; light gray (5Y 7/2) clay loam, light olive gray (5Y 6/2) moist; many fine distinct mottles, yellowish brown (10YR 5/6) and light olive brown (2.5Y 5/4) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

C3gca—29 to 37 inches; light olive gray (5Y 6/2) clay loam, olive gray (5Y 5/2) moist; common fine prominent mottles, yellowish brown (10YR 5/6) and gray (5Y 6/1) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; few fine concretions of iron and manganese oxide; strong effervescence; moderately alkaline; clear wavy boundary.

C4g—37 to 43 inches; light olive gray (5Y 6/2) clay loam, olive gray (5Y 5/2) moist; few medium distinct mottles, yellowish brown (10YR 5/6) and dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; few fine concretions of iron and manganese oxide; slight effervescence; moderately alkaline; clear wavy boundary.

C5g—43 to 60 inches; gray (5Y 6/1) clay loam, olive gray (5Y 5/2) moist; few fine distinct mottles, yellowish brown (10YR 5/6) and dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine to coarse accumulations of carbonate; few fine concretions of iron and manganese oxide; slight effervescence; moderately alkaline.

The control section may average as low as 22 percent clay and as high as 30 percent clay. The calcium carbonate equivalent ranges from 20 to 30 percent in some part of the C horizon within a depth of 16 inches. The mollic epipedon is 7 to 22 inches thick.

The A horizon has hue of 10YR, 2.5Y, or 5Y, value of 2 or 3 moist, and chroma of 1 or is neutral in color. It is loam, silt loam, silty clay loam, or clay loam. It is neutral or mildly alkaline and is 6 to 18 inches thick. The C horizon has value of 4 to 7 and chroma of 1 to 3. It is loam or clay loam.

Vida series

The Vida series consists of deep, well drained soils formed in glacial till. These soils are moderately permeable through the solum and moderately slowly permeable in the underlying material. They are on uplands. Slopes range from 3 to 25 percent.

Vida soils commonly are near Bowbells, Williams, and Zahl soils. Bowbells soils have a mollic epipedon that is more than 16 inches thick. Williams soils have free carbonates below a depth of 10 inches. Zahl soils lack a B horizon.

Typical pedon of Vida loam, in an area of Vida-Zahl loams, 6 to 15 percent slopes, 1,690 feet north and 65 feet east of the southwest corner of sec. 31, T. 126 N., R. 74 W.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak very fine granular structure; slightly hard, friable; neutral; clear smooth boundary.

B2t—4 to 8 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B3ca—8 to 20 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine prismatic structure parting to weak fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.

C1ca—20 to 32 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; few fine faint relic mottles, yellowish brown (10YR 5/6) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—32 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; few fine distinct relic mottles, dark brown (7.5YR 4/4) moist, and common fine faint mottles, yellowish brown (10YR 5/6) moist; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to free carbonates is 6 to 10 inches. The solum ranges from 8 to 24 inches in thickness.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 2 or 3. It is clay loam, loam, or very stony loam and is 3 to 7 inches thick. The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. The C horizon has hue of 10YR or 2.5Y, value of 6 or 7 (4 to 6 moist), and chroma of 1 to 4. It is loam or clay loam.

Wabek series

The Wabek series consists of excessively drained soils that are very shallow or shallow over sand and gravel. Permeability is rapid. These soils formed in loamy material over glacial outwash. They are on terraces. Slopes range from 2 to 25 percent.

Wabek soils commonly are near Bowdle, Lehr, and Tally soils. Bowdle and Lehr soils have sand and gravel below a depth of 14 inches. Tally soils are coarse-loamy.

Typical pedon of Wabek loam, in an area of Wabek-Lehr loams, 6 to 15 percent slopes, 300 feet west and 100 feet south of the northeast corner of sec. 2, T. 125 N., R. 74 W.

A1—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; mildly alkaline; abrupt wavy boundary.

IIC1—6 to 10 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse subangular blocky structure and single grained; loose; strong effervescence; mildly alkaline; gradual wavy boundary.

IIC2—10 to 60 inches; multicolored sand and gravel; single grained; loose; strong effervescence; moderately alkaline.

The depth to sand and gravel is 7 to 14 inches, and the depth to free carbonates is 4 to 8 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2. It typically is loam but in some pedons is gravelly loam, sandy loam, loamy sand, or gravelly loamy sand. It is 5 to 11 inches thick.

Williams series

The Williams series consists of deep, well drained soils formed in glacial till. Permeability is moderate in the solum and moderately slow in the underlying material. These soils are on uplands. Slopes range from 0 to 9 percent.

Williams soils commonly are near Bowbells, Vida, and Zahl soils. Bowbells soils have a mollic epipedon that is more than 16 inches thick. Vida soils have free carbonates within a depth of 10 inches. Zahl soils lack a B horizon.

Typical pedon of Williams loam, in an area of Williams-Bowbells loams, 3 to 6 percent slopes, 1,914 feet north and 84 feet east of the southwest corner of sec. 8, T. 125 N., R. 75 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure parting to moderate fine granular; slightly hard, friable; neutral; clear smooth boundary.

B21t—6 to 13 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; strong medium prismatic structure parting to strong medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; gradual smooth boundary.

B22t—13 to 19 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; strong medium prismatic structure parting to strong medium

subangular blocky; hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear wavy boundary.

B3ca—19 to 25 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C1ca—25 to 31 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—31 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 10 to 30 inches.

The A horizon is loam, silt loam, or clay loam and is 4 to 9 inches thick. It has value of 4 or 5 (2 or 3 moist) and dominantly has chroma of 2. In some areas that support native grass, the upper 1 to 3 inches has chroma of 1. The B horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. It is loam or clay loam, and it may average as low as 24 percent clay and as high as 35 percent clay. The C horizon has hue of 2.5Y or 5Y, value of 5 to 8 (4 to 6 moist), and chroma of 2 to 4. It is loam or clay loam.

The Williams soil occurring as part of the map unit Williams-Noonan loams, 0 to 4 percent slopes, contains more clay in the B2t horizon than is defined as the range for the series. This difference, however, does not alter the use or behavior of this soil.

Wyndmere series

The Wyndmere series consists of deep, somewhat poorly drained soils formed in loamy and sandy material. Permeability is moderately rapid. These soils are on upland terraces. Slopes range from 0 to 3 percent.

Wyndmere soils commonly are near Maddock, Tally, and Yecross soils and are similar to Arveson, Regan, and Vallers soils. Arveson soils are poorly drained. Maddock, Tally, and Yecross soils lack a calcic horizon. Regan soils are fine-silty. Vallers soils are fine-loamy.

Typical pedon of Wyndmere fine sandy loam, 0 to 3 percent slopes, 1,543 feet south and 39 feet east of the northwest corner of sec. 21, T. 125 N., R. 76 W.

A11—0 to 7 inches; very dark gray (10YR 3/1) fine sandy loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine and medium granular; slightly hard, friable; slight effervescence; moderately alkaline; gradual smooth boundary.

A12ca—7 to 13 inches; dark gray (10YR 4/1) fine sandy loam, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to weak medium and coarse subangular blocky; slightly hard, friable; violent effervescence; moderately alkaline; gradual wavy boundary.

C1ca—13 to 22 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; violent effervescence; moderately alkaline; gradual wavy boundary.

C2—22 to 40 inches; grayish brown (2.5Y 5/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable; violent effervescence; moderately alkaline; gradual wavy boundary.

C3—40 to 60 inches; light brownish gray (2.5Y 6/2) loamy fine sand, grayish brown (2.5Y 5/2) moist; common fine distinct mottles, yellowish brown (10YR 5/6) moist; single grained; soft, very friable; strong effervescence; moderately alkaline.

The control section typically is fine sandy loam, but in some pedons it is loamy fine sand, fine sand, or loam below a depth of 25 inches. The calcium carbonate equivalent averages as low as 15 percent in some pedons and as high as 30 percent in others. The mollic epipedon is 7 to 16 inches thick.

The A horizon has value of 3 to 5 (2 to 4 moist). It is fine sandy loam, sandy loam, or loam and is 7 to 15 inches thick. The Cca horizon has hue of 10YR or 2.5Y, value of 4 to 7 (3 to 5 moist), and chroma of 1 or 2. The C2 and C3 horizons have hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4.

Yecross series

The Yecross series consists of deep, excessively drained soils formed in sandy glacial outwash sediments. Permeability is rapid. These soils are on terraces and on uplands. Slopes range from 0 to 15 percent.

Yecross soils commonly are near Maddock, Tally, and Wyndmere soils and are similar to Seroco soils. Maddock and Tally soils have a cambic horizon. In addition, Tally soils are coarse-loamy. Seroco soils are not underlain by sand and gravel. Wyndmere soils have a calcic horizon.

Typical pedon of Yecross loamy sand, 0 to 6 percent slopes, 1,245 feet north and 42 feet east of the southwest corner of sec. 27, T. 125 N., R. 76 W.

A1—0 to 8 inches; dark gray (10YR 4/1) loamy sand, very dark gray (10YR 3/1) moist; weak fine and

medium granular structure; soft, very friable; neutral; clear wavy boundary.
C1—8 to 40 inches; brown (10YR 5/3) sand, dark brown (10YR 4/3) moist; single grained; loose; slight effervescence; mildly alkaline; gradual wavy boundary.
C2—40 to 60 inches; grayish brown (10YR 5/2) gravelly sand, dark grayish brown (10YR 4/2) moist; single grained; slight effervescence; moderately alkaline.

The depth to free carbonates typically is about 8 to 10 inches but ranges from 0 to 20 inches. The control section ranges from loamy sand to very coarse sand. Colors with moist value of 3 or less extend below a depth of 10 inches in some pedons, but the soils do not have a mollic epipedon because they do not have sufficient organic carbon.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is loamy sand, loamy fine sand, or sandy loam and is 5 to 10 inches thick. It is neutral or mildly alkaline. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is dominantly loamy sand, sand, or gravelly sand, but in some pedons loose sand and gravel is below a depth of 30 inches.

Zahl series

The Zahl series consists of deep, well drained soils formed in glacial till. Permeability is moderate in the upper horizons and moderately slow in the underlying material. These soils are on uplands. Slopes range from 6 to 35 percent.

Zahl soils commonly are near Bowbells, Vida, and Williams soils. These nearby soils have an argillic horizon.

Typical pedon of Zahl loam in an area of Zahl-Vida loams, 9 to 30 percent slopes, 1,599 feet east and 63 feet south of the northwest corner of sec. 32, T. 126 N., R. 74 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak fine and medium granular; soft, friable; mildly alkaline; clear wavy boundary.
C1ca—5 to 14 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure parting to weak fine and medium granular; slightly hard, friable; common fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.
C2—14 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium accumulations of carbonate; violent effervescence; moderately alkaline.

The control section may average as low as 20 percent clay and as high as 28 percent clay. Free carbonates are within a depth of 10 inches.

The A horizon has hue of 10YR or 2.5Y and value of 3 to 5 (2 or 3 moist). It is loam or clay loam and is 4 to 7 inches thick. Some pedons have an AC horizon. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4.

Formation of the soils

This section relates the major factors of soil formation to the soils of Campbell County.

Factors of soil formation

Soil forms when soil-forming processes act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief, and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil having genetically related horizons. Some time is always required for differentiation of soil horizons. Usually, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Climate

The continental climate of Campbell County is one of cold winters and hot summers. The average annual precipitation is about 15 inches, about 70 percent of which falls during the growing season. The average annual air temperature is about 43 degrees F. The average for July is about 72 degrees, and the average for January is about 9 degrees.

This climate has favored the accumulation of organic matter in the surface layer of the soils and has promoted moderately slow weathering of bedrock and soil formation. Because it generally is uniform throughout the county, climate alone does not account for many of the

differences among the soils in the county. Additional climatic data are given in the section "General nature of the county."

Plant and animal life

Plants, animals, insects, earthworms, bacteria, and fungi are important in the formation of soils. The natural vegetation of the county was mainly mid and short grasses.

Plants affect the amount of organic matter and nutrients in the soil. Their effect is conditioned by climate and relief. Most nearly level to sloping soils support similar kinds and amounts of vegetation. The content of organic matter generally is medium to high. Steeper soils, such as Zahl and Sansarc, have a different composition of grasses. The effects of the plants on these soils are conditioned by erosion and loss of rainfall through runoff. Thus, these soils have a thinner A horizon and less organic matter than the more nearly level soils.

Earthworms and burrowing animals help to keep the soil open and porous. Bacteria and fungi decompose the vegetation, thus releasing nutrients available to plants as food.

Parent material

Parent material is the unconsolidated mass in which a soil forms. Most of the soils in Campbell County formed in glacial material derived from preglacial formations of granite, gneiss, limestone, sandstone, and shale. As the glacier transported the materials from these formations, it ground and mixed them, and then it redeposited them as it melted. Some deposits consist of unsorted materials, or glacial till. Other deposits are material sorted either by water during deposition or by wind and water after deposition. These deposits include silty glacial drift, outwash sand and gravel, and alluvial sediments. Of these materials, glacial till and silty glacial drift are the most extensive. They are related to the physiography of the Missouri Coteau (*4*).

The Missouri Coteau has landforms that are characteristic of the glacial stagnation and deposition during the Wisconsin stage of the Pleistocene epoch. These landforms include ground moraines, which are made up of stagnant drift and have low relief, and end moraines and other landforms that are made up of stagnant drift and have high relief.

Most of the ground moraines are nearly level to undulating. The drainage pattern is poorly defined, and the landscape is characterized by few to numerous potholes or closed depressions. The glacial till in these areas is an assorted mixture of silt, clay, sand, and gravel occurring in proportions that differ from one place to another. The soils have a dominant texture of loam or clay loam. An example is Williams soils.

The end moraines and other landforms having high relief are mainly in the east-central part of the county. Vida and Zahl are examples of soils that formed in the stagnant drift on these landforms. Scattered cobblestones and stones commonly are throughout the areas of glacial till.

Deposits of glacial drift that has been sorted and has a high content of silt are referred to as silty glacial drift. Bryant soils are the most extensive of the soils that formed in the silty glacial drift on the Missouri Coteau. A few scattered pebbles are on the surface in places, but the silty glacial drift generally contains no stones and boulders.

Glacial outwash is another example of glacial till that has been sorted by water or wind. Lehr, Bowdle, and Wabek soils are examples of soils affected by the melt water of the retreating glacier on the Missouri Coteau. These soils formed in loamy material underlain by outwash sand and gravel. Other examples of soils formed in glacial outwash include Maddock, Tally, and Yecross soils, which are mainly in the southern and central parts of the county. Maddock and Yecross soils formed in outwash sand that has been reworked and redeposited by wind. They generally are sandy.

The Pierre Formation, a marine shale of the Cretaceous age, is exposed in Campbell County. The exposures are mainly along the Missouri River. Many areas were covered with thin glacial deposits that were subsequently eroded away, leaving only scattered boulders on the surface. Opal, Sansarc, and Promise are examples of soils formed in material weathered from this shale.

The Fox Hills Formation is another example of exposed bedrock, in the northwest corner of the county. This formation is sandstone of Cretaceous age. Flasher and Lihen are examples of soils formed in material weathered from this sandstone.

Loess mantles the uplands in the western part of the county, generally in the areas within a few miles of the Missouri River. This wind-deposited material varies in thickness over glacial till. It is generally more than 40 inches thick. Linton soils are the most extensive of the soils formed in loess. Other examples are Sully and Sutley soils.

Alluvium is another kind of parent material in which the soils of Campbell County formed. Harriet and Ranslo soils formed in alluvium deposited by streams. They are in most of the areas along Spring Creek. Farnuf soils are the most extensive of the soils formed in alluvium deposited on upland terraces. Bowbells and Grassna soils formed in alluvium washed in from adjacent soils and deposited in swales. Parnell and Tonka are examples of soils formed in alluvium that washed in from higher areas and was deposited in potholes or closed depressions.

Relief

Relief affects drainage, plant cover, soil temperature, biological activity, rate of erosion, and deposition of sedi-

ments. The differences among Bowbells, Tonka, Vida, Williams, and Zahl soils are associated with relief.

On the Zahl soils, which are in the steeper areas on the landscape, much of the rainfall is lost because of runoff. Erosion is active, and plant growth is limited. As a result, these soils are low in organic matter content and are calcareous at or near the surface. More rainfall enters the Vida and Williams soils, which are less steep. Organic matter content is moderate in the upper horizons. Also, carbonates are leached further through these soils than through the Zahl soils.

The Bowbells soils, which are in swales, receive runoff from the adjacent uplands. They have a high organic matter content and thicker A and B horizons than the Vida and Williams soils. Also, they are leached of carbonates to a greater depth. Tonka soils, which are in closed depressions, have colors and mottles characteristic of poorly drained soils.

Time

The length of time that the climate, plant and animal life, and relief have affected the parent material determines the kind of soils that form. Older soils, such as Williams and Bryant, have well defined horizons. Examples of younger soils are Sully and Sutley soils, which formed in loess, and Straw soils, which formed in recent alluvium.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*8*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 18, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Boroll (*Bor*, meaning cool, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Haploborolls (*Hapl*, meaning simple horizons, plus *boroll*, the suborder of Mollisols that have a frigid temperature regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Haploborolls.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-silty, mixed Typic Haploborolls.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Complex, soil. A map unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

Crop residue management. Use of that portion of a plant or crop left in the field after harvest for protection or improvement of the soil.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized.

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Excess salts. Excess water soluble salts. Excessive salts restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average

of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Foot slope. The inclined surface at the base of a hill.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the assorted and unassorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by melt water as it flows from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

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Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. Inadequate strength for supporting loads.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Types are terminal, lateral, medial, and ground.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Piping. Moving water forms subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Proper grazing use. Management of grazing on range and pasture that maintains adequate plant cover for soil protection and maintains or improves the quality and quantity of desirable vegetation.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land supporting some forest trees.

Range condition. The health or productivity of forage plants on a given range, in terms of the potential productivity under normal climate and the best practical management. Condition classes generally recognized are—*excellent, good, fair,* and *poor*. The classification is based on the percentage of original, or assumed climax vegetation on a site, as compared to what has been observed to grow on it when well managed.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind and amount of native vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can

damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slick spot. Locally, a small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake. The slow movement of water into the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil depth. The depth to bedrock. The soil is *shallow* if it is 10 to 20 inches deep over bedrock, *moderately deep* if it is 20 to 40 inches deep over bedrock, and *deep* if it is more than 40 inches deep over bedrock.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently referred to as the "plow layer," or the "Ap horizon."

Surface soil. All of the A horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.
Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.
Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-74 at Pollock, South Dakota]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	20.9	-2.6	9.2	52	-35	0	.33	.08	.52	1	5.6
February	27.8	3.8	15.8	58	-33	10	.41	.15	.61	2	5.8
March	38.7	15.8	27.3	74	-18	69	.61	.09	1.01	2	3.5
April	56.3	30.6	43.5	86	10	163	1.75	.40	2.83	4	1.3
May	69.7	42.2	55.9	92	22	493	2.87	1.77	3.85	6	.1
June	78.7	52.6	65.7	99	36	771	3.23	1.74	4.44	7	.0
July	86.3	57.4	71.9	104	42	989	2.29	1.22	3.15	5	.0
August	86.3	55.7	71.0	104	38	961	1.75	1.04	2.38	4	.0
September	73.9	44.1	59.0	98	23	570	1.26	.38	1.96	3	.0
October	62.4	33.2	47.8	89	14	271	.83	.15	1.35	2	.2
November	41.7	18.4	30.1	69	-10	42	.44	.05	.72	2	1.7
December	27.9	5.6	16.9	58	-28	14	.40	.11	.63	2	6.7
Yearly:											
Average	55.9	30.0	42.8	---	---	---	---	---	---	---	---
Extreme	---	---	---	105	-37	---	---	---	---	---	---
Total	---	---	---	---	---	4,353	16.17	12.82	19.18	40	24.9

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-74 at Pollock, South Dakota]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 12	May 19	May 25
2 years in 10 later than--	May 6	May 14	May 21
5 years in 10 later than--	April 24	May 5	May 14
First freezing temperature in fall:			
1 year in 10 earlier than--	September 23	September 13	September 3
2 years in 10 earlier than--	September 29	September 19	September 9
5 years in 10 earlier than--	October 10	October 1	September 20

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-74 at Pollock, South Dakota]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	140	124	109
8 years in 10	150	132	116
5 years in 10	168	148	128
2 years in 10	187	163	141
1 year in 10	197	171	148

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1A	Bowbells loam	10,080	2.2
2	Grail silty clay loam	4,325	0.9
4	Grassna silt loam	5,260	1.1
5	Williams-Noonan loams, 0 to 4 percent slopes	4,845	1.0
7A	Hamerly silt loam, 0 to 3 percent slopes	1,255	0.3
7B	Hamerly silt loam, 3 to 6 percent slopes	460	0.1
9C	Seroco loamy fine sand, 2 to 15 percent slopes	395	0.1
9E	Seroco-Dune land complex	315	(*)
10	Hurley silt loam, 0 to 6 percent slopes	4,750	1.0
11	Hurley-Slickspots complex, 0 to 6 percent slopes	2,305	0.5
13A	Tally fine sandy loam, 0 to 3 percent slopes	3,320	0.7
13B	Tally fine sandy loam, 3 to 6 percent slopes	14,888	3.2
13C	Tally fine sandy loam, 6 to 9 percent slopes	3,525	0.8
15	Harriet silt loam	6,820	1.5
16	Egas silty clay loam	1,185	0.3
17	Hecla loamy sand	1,020	0.2
18	Parshall fine sandy loam	1,070	0.2
19	Heil silt loam	1,650	0.4
20D	Sully silt loam, 9 to 25 percent slopes	3,080	0.7
21A	Linton-Grassna silt loams, 0 to 3 percent slopes	10,670	2.3
21B	Linton silt loam, 3 to 6 percent slopes	16,315	3.5
21C	Linton-Sutley silt loams, 6 to 9 percent slopes	4,905	1.0
21D	Sully-Zahl complex, 9 to 40 percent slopes	1,395	0.3
22B	Linton-Sutley silt loams, 2 to 6 percent slopes	2,170	0.5
22C	Linton silt loam, 6 to 9 percent slopes	1,860	0.4
24A	Yecross loamy sand, 0 to 6 percent slopes	8,320	1.8
24C	Yecross loamy sand, 6 to 15 percent slopes	1,010	0.2
27B	Maddock loamy fine sand, 0 to 6 percent slopes	6,025	1.3
27C	Maddock loamy fine sand, 6 to 12 percent slopes	985	0.2
28	Wyndmere fine sandy loam, 0 to 3 percent slopes	1,280	0.3
29	Vallers loam	1,250	0.3
30	Parnell silty clay loam, ponded	2,980	0.6
31E	Lihen loamy fine sand, 9 to 20 percent slopes	1,435	0.3
32F	Flasher loamy fine sand, 25 to 50 percent slopes	660	0.1
34A	Bowdle loam, 0 to 3 percent slopes	6,660	1.4
34B	Bowdle loam, 3 to 6 percent slopes	5,555	1.2
36B	Lehr-Wabek loams, 2 to 6 percent slopes	9,590	2.0
38	Parnell silty clay loam	5,105	1.1
39E	Sansarc-Opal clays, 15 to 40 percent slopes	18,705	4.0
40B	Opal clay, 3 to 6 percent slopes	1,005	0.2
40C	Opal clay, 6 to 9 percent slopes	2,185	0.5
40D	Opal-Sansarc clays, 6 to 15 percent slopes	8,325	1.8
41A	Promise clay, 0 to 3 percent slopes	2,065	0.4
41B	Promise clay, 3 to 6 percent slopes	2,210	0.5
41C	Promise-Opal clays, 6 to 9 percent slopes	1,245	0.3
51	Tonka silt loam	9,970	2.1
52A	Lehr loam, 0 to 3 percent slopes	5,525	1.2
52B	Lehr loam, 3 to 6 percent slopes	9,160	2.0
53D	Wabek-Lehr loams, 6 to 15 percent slopes	7,810	1.7
53E	Wabek loam, 9 to 25 percent slopes	1,565	0.3
54	Divide loam, 0 to 4 percent slopes	835	0.2
56	Regan silt loam	1,320	0.3
57A	Williams-Bowbells loams, 0 to 3 percent slopes	19,683	4.2
57B	Williams-Bowbells loams, 3 to 6 percent slopes	71,580	15.2
57C	Williams-Vida loams, 6 to 9 percent slopes	35,630	7.6
58B	Williams-Vida loams, 3 to 6 percent slopes	4,150	0.9
59D	Vida-Zahl loams, 6 to 15 percent slopes	28,280	6.0
61E	Zahl-Vida loams, 9 to 30 percent slopes	9,560	2.0
62	Vida very stony loam, 3 to 15 percent slopes	1,390	0.3
65B	Bryant-Sutley silt loams, 2 to 6 percent slopes	3,600	0.8
65C	Bryant-Sutley silt loams, 6 to 9 percent slopes	4,185	0.9
65D	Sutley-Linton silt loams, 9 to 15 percent slopes	695	0.1
66	Arveson fine sandy loam	285	(*)
67A	Farnuf loam, 0 to 3 percent slopes	3,945	0.8
67B	Farnuf loam, 3 to 6 percent slopes	2,405	0.5
68A	Bryant-Grassna silt loams, 0 to 3 percent slopes	9,510	2.0
68B	Bryant silt loam, 3 to 6 percent slopes	28,185	6.0
68C	Bryant silt loam, 6 to 9 percent slopes	3,050	0.7
71	Ranslo-Harriet silt loams	5,045	1.1
72	Straw loam, channeled	1,660	0.4
74A	Savage silt loam, 0 to 3 percent slopes	650	0.1
74B	Savage silt loam, 3 to 6 percent slopes	460	0.1

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
77	Pits, gravel	375	0.1
80	Ranslo silt loam	3,495	0.7
	Water (<40 acres in size)	275	(*)
	Total land area	468,736	100.0
	Water (>40 acres in size)	24,064	
	Total area	492,800	

* Less than 0.1 percent.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Only arable soils are listed. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Oats	Spring wheat	Alfalfa hay	Cool season grass
	Bu	Bu	Bu	Ton	AUM*
1A---------- Bowbells	50	67	31	3.0	4.8
2---------- Grail	46	63	31	2.8	4.5
4---------- Grassna	51	67	31	2.9	4.6
5---------- Williams-Noonan	28	33	22	1.5	2.4
7A---------- Hamerly	36	52	21	2.1	3.5
7B---------- Hamerly	34	42	19	2.0	3.2
13A---------- Tally	40	46	20	1.6	2.6
13B---------- Tally	38	44	19	1.6	2.6
13C---------- Tally	31	39	15	1.5	2.4
17---------- Hecla	32	33	19	1.8	2.9
18---------- Parshall	46	48	23	1.8	2.9
21A---------- Linton-Grassna	40	55	27	2.3	3.7
21B---------- Linton	34	45	22	1.7	2.7
21C---------- Linton-Sutley	26	37	16	1.4	2.2
22B---------- Linton-Sutley	31	42	19	1.6	2.6
22C---------- Linton	29	39	18	1.4	2.2
24A---------- Yecross	25	26	12	1.3	2.1
27B---------- Maddock	28	27	13	1.4	2.2
28---------- Wyndmere	39	50	20	2.4	3.8

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Oats	Spring wheat	Alfalfa hay	Cool season grass
	Bu	Bu	Bu	Ton	AUM*
34A---------- Bowdle	30	44	21	1.2	1.9
34B---------- Bowdle	28	41	19	1.1	1.9
36B---------- Lehr-Wabek	16	24	12	.7	1.1
40B---------- Opal	23	41	21	1.4	2.2
40C---------- Opal	19	33	16	1.3	2.1
41A---------- Promise	26	50	24	1.5	2.4
41B---------- Promise	24	48	23	1.5	2.4
41C---------- Promise-Opal	20	37	18	1.3	2.1
52A---------- Lehr	20	34	16	1.1	1.9
52B---------- Lehr	18	30	13	1.0	1.6
54---------- Divide	---	45	20	1.6	2.6
57A---------- Williams-Bowbells	42	61	29	2.2	3.5
57B---------- Williams-Bowbells	39	59	27	2.1	3.4
57C---------- Williams-Vida	28	42	20	1.5	2.4
58B---------- Williams-Vida	30	48	23	1.8	2.9
59D---------- Vida-Zahl	18	33	14	1.0	1.6
65B---------- Bryant-Sutley	32	45	23	1.8	2.9
65C---------- Bryant-Sutley	27	40	18	1.4	2.2
65D---------- Sutley-Linton	18	28	10	1.2	1.9
67A---------- Farnuf	38	55	27	1.9	3.0

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Oats	Spring wheat	Alfalfa hay	Cool season grass
	Bu	Bu	Bu	Ton	AUM*
67B---------- Farnuf	36	50	24	1.9	3.0
68A---------- Bryant-Grassna	42	61	29	2.3	3.7
68B---------- Bryant	35	52	27	1.9	3.0
68C---------- Bryant	29	44	22	1.6	2.6
71---------- Ranslo-Harriet	---	30	14	1.7	2.7
72---------- Straw	---	---	---	3.4	5.4
74A---------- Savage	34	52	28	1.9	3.0
74B---------- Savage	32	49	25	1.9	3.0
80---------- Ranslo	---	40	19	2.2	3.5

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
1A	Overflow	Favorable	4,300	Big bluestem	45
Bowbells		Normal	3,600	Western wheatgrass	20
		Unfavorable	2,500	Green needlegrass	15
				Sideoats grama	5
				Leadplant	5
				Sedge	5
2	Overflow	Favorable	4,300	Big bluestem	25
Grail		Normal	3,600	Western wheatgrass	25
		Unfavorable	2,500	Green needlegrass	15
				Sedge	10
				Needleandthread	5
4	Overflow	Favorable	4,300	Big bluestem	45
Grassna		Normal	3,600	Western wheatgrass	20
		Unfavorable	2,500	Green needlegrass	15
				Sideoats grama	5
				Leadplant	5
				Sedge	5
5*:					
Williams	Silty	Favorable	3,200	Western wheatgrass	30
		Normal	2,700	Needleandthread	20
		Unfavorable	1,900	Green needlegrass	20
				Little bluestem	10
				Blue grama	10
				Sedge	5
				Big bluestem	5
Noonan	Claypan	Favorable	2,100	Western wheatgrass	40
		Normal	1,800	Blue grama	20
		Unfavorable	1,300	Green needlegrass	15
				Sedge	10
7A, 7B	Silty	Favorable	3,100	Needleandthread	25
Hamerly		Normal	2,700	Green needlegrass	20
		Unfavorable	2,300	Western wheatgrass	15
				Little bluestem	10
				Big bluestem	10
				Blue grama	5
				Sideoats grama	5
				Sedge	5
9C	Sands	Favorable	3,000	Little bluestem	30
Seroco		Normal	2,500	Prairie sandreed	20
		Unfavorable	1,700	Sand bluestem	20
				Needleandthread	10
				Blue grama	5
				Sedge	5
9E*:					
Seroco	Sands	Favorable	3,000	Little bluestem	30
		Normal	2,500	Prairie sandreed	20
		Unfavorable	1,700	Sand bluestem	20
				Needleandthread	10
				Blue grama	5
				Sedge	5
Dune land.					

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
10---------- Hurley	Thin Claypan----------	Favorable	1,700	Blue grama----------	30
		Normal	1,400	Western wheatgrass----------	25
		Unfavorable	900	Needleandthread----------	15
				Buffalograss----------	10
				Sedge----------	10
11*:					
Hurley----------	Thin Claypan----------	Favorable	1,700	Blue grama----------	30
		Normal	1,400	Western wheatgrass----------	25
		Unfavorable	900	Needleandthread----------	15
				Buffalograss----------	10
				Sedge----------	10
Slickspots.					
13A, 13B, 13C------ Tally	Sandy----------	Favorable	3,000	Little bluestem----------	25
		Normal	2,500	Needleandthread----------	15
		Unfavorable	1,700	Prairie sandreed----------	15
				Blue grama----------	10
				Sideoats grama----------	10
				Western wheatgrass----------	10
15---------- Harriet	Saline Lowland----------	Favorable	2,900	Western wheatgrass----------	30
		Normal	2,500	Inland saltgrass----------	25
		Unfavorable	2,100	Nuttall alkaligrass----------	15
				Cordgrass----------	15
				Bluegrass----------	10
16---------- Egas	Saline Lowland----------	Favorable	3,700	Cordgrass----------	30
		Normal	3,400	Nuttall alkaligrass----------	20
		Unfavorable	2,700	Western wheatgrass----------	20
				Inland saltgrass----------	20
17---------- Hecla	Sands----------	Favorable	3,100	Little bluestem----------	30
		Normal	2,600	Sand bluestem----------	20
		Unfavorable	1,800	Prairie sandreed----------	20
				Needleandthread----------	10
				Switchgrass----------	5
				Canada wildrye----------	5
				Sedge----------	5
18---------- Parshall	Sandy----------	Favorable	3,100	Little bluestem----------	30
		Normal	2,600	Prairie sandreed----------	20
		Unfavorable	1,800	Needleandthread----------	15
				Sideoats grama----------	10
				Blue grama----------	10
				Sedge----------	5
19---------- Heil	Closed Depression----------	Favorable	3,400	Western wheatgrass----------	75
		Normal	3,100	Sedge----------	10
		Unfavorable	2,200		
20D---------- Sully	Thin Upland----------	Favorable	2,800	Little bluestem----------	30
		Normal	2,300	Sideoats grama----------	15
		Unfavorable	1,600	Needleandthread----------	15
				Western wheatgrass----------	10
				Blue grama----------	10
				Sedge----------	5
				Plains muhly----------	5
21A*:					
Linton----------	Silty----------	Favorable	3,100	Green needlegrass----------	30
		Normal	2,600	Western wheatgrass----------	25
		Unfavorable	1,800	Needleandthread----------	15
				Little bluestem----------	10
				Blue grama----------	5
				Sedge----------	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
21A*:					
Grassna	Overflow	Favorable	4,300	Big bluestem	45
		Normal	3,600	Western wheatgrass	20
		Unfavorable	2,500	Green needlegrass	15
				Sideoats grama	5
				Leadplant	5
				Sedge	5
21B	Silty	Favorable	3,100	Green needlegrass	30
Linton		Normal	2,600	Western wheatgrass	25
		Unfavorable	1,800	Needleandthread	15
				Little bluestem	10
				Blue grama	5
				Sedge	5
21C*:					
Linton	Silty	Favorable	3,100	Green needlegrass	30
		Normal	2,600	Western wheatgrass	25
		Unfavorable	1,800	Needleandthread	15
				Little bluestem	10
				Blue grama	5
				Sedge	5
Sutley	Thin Upland	Favorable	3,000	Little bluestem	25
		Normal	2,500	Needleandthread	25
		Unfavorable	1,700	Western wheatgrass	20
				Blue grama	15
				Sideoats grama	10
				Sedge	5
21D*:					
Sully	Thin Upland	Favorable	2,800	Little bluestem	30
		Normal	2,300	Sideoats grama	15
		Unfavorable	1,600	Needleandthread	15
				Western wheatgrass	10
				Blue grama	10
				Sedge	5
				Plains muhly	5
Zahl	Thin Upland	Favorable	2,600	Little bluestem	30
		Normal	2,200	Needleandthread	15
		Unfavorable	1,200	Sideoats grama	15
				Western wheatgrass	10
				Plains muhly	5
				Sedge	5
				Blue grama	5
22B*:					
Linton	Silty	Favorable	3,100	Green needlegrass	30
		Normal	2,600	Western wheatgrass	25
		Unfavorable	1,800	Needleandthread	15
				Little bluestem	10
				Blue grama	5
				Sedge	5
Sutley	Thin Upland	Favorable	3,000	Little bluestem	25
		Normal	2,500	Needleandthread	25
		Unfavorable	1,700	Western wheatgrass	20
				Blue grama	15
				Sideoats grama	10
				Sedge	5
22C	Silty	Favorable	3,100	Green needlegrass	30
Linton		Normal	2,600	Western wheatgrass	25
		Unfavorable	1,800	Needleandthread	15
				Little bluestem	10
				Blue grama	5
				Sedge	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
24A, 24C---------- Yecross	Sands----------	Favorable	3,000	Sand bluestem----------	35
		Normal	2,500	Prairie sandreed----------	20
		Unfavorable	1,750	Little bluestem----------	15
				Needleandthread----------	10
				Sand dropseed----------	5
				Blue grama----------	5
				Sedge----------	5
27B, 27C---------- Maddock	Sands----------	Favorable	3,400	Little bluestem----------	25
		Normal	2,800	Prairie sandreed----------	20
		Unfavorable	2,000	Sand bluestem----------	20
				Needleandthread----------	10
				Switchgrass----------	5
				Canada wildrye----------	5
				Sedge----------	5
				Leadplant----------	5
28---------- Wyndmere	Sandy----------	Favorable	3,200	Needleandthread----------	20
		Normal	2,700	Little bluestem----------	20
		Unfavorable	1,900	Prairie sandreed----------	15
				Western wheatgrass----------	10
				Big bluestem----------	10
				Blue grama----------	5
				Sedge----------	5
				Sideoats grama----------	5
29---------- Vallers	Subirrigated----------	Favorable	5,500	Big bluestem----------	60
		Normal	5,000	Switchgrass----------	15
		Unfavorable	4,000	Sedge----------	10
				Indiangrass----------	5
				Kentucky bluegrass----------	5
31E---------- Lihen	Sandy----------	Favorable	3,100	Prairie sandreed----------	25
		Normal	2,600	Little bluestem----------	20
		Unfavorable	1,800	Needleandthread----------	15
				Big bluestem----------	15
				Western wheatgrass----------	5
				Sedge----------	5
				Blue grama----------	5
32F---------- Flasher	Shallow----------	Favorable	2,300	Little bluestem----------	25
		Normal	1,900	Needleandthread----------	25
		Unfavorable	1,300	Blue grama----------	10
				Sedge----------	5
				Plains muhly----------	5
				Western wheatgrass----------	5
				Prairie sandreed----------	5
34A, 34B---------- Bowdle	Silty----------	Favorable	2,900	Green needlegrass----------	30
		Normal	2,400	Western wheatgrass----------	25
		Unfavorable	1,700	Needleandthread----------	25
				Blue grama----------	10
				Sedge----------	5
36B*:					
Lehr----------	Shallow to Gravel----------	Favorable	2,200	Needleandthread----------	35
		Normal	1,800	Blue grama----------	20
		Unfavorable	1,100	Little bluestem----------	10
				Sedge----------	10
				Plains muhly----------	5
Wabek----------	Very Shallow----------	Favorable	1,400	Blue grama----------	30
		Normal	1,200	Needleandthread----------	25
		Unfavorable	800	Threadleaf sedge----------	20
				Plains muhly----------	5
38---------- Parnell	Wetland----------	Favorable	6,200	Slough sedge----------	35
		Normal	5,600	Rivergrass----------	30
		Unfavorable	4,500	Prairie cordgrass----------	15
				Reedgrass----------	10

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
39E*:					
Sansarc	Shallow Clay	Favorable	2,300	Little bluestem	35
		Normal	1,900	Western wheatgrass	20
		Unfavorable	1,300	Sideoats grama	10
				Green needlegrass	10
				Big bluestem	10
				Blue grama	5
				Sedge	5
Opal	Clayey	Favorable	2,600	Western wheatgrass	30
		Normal	2,200	Green needlegrass	25
		Unfavorable	1,500	Sideoats grama	10
				Blue grama	10
				Little bluestem	10
				Sedge	10
40B, 40C	Clayey	Favorable	2,900	Western wheatgrass	40
Opal		Normal	2,400	Green needlegrass	30
		Unfavorable	1,700	Blue grama	10
				Sideoats grama	5
				Little bluestem	5
				Sedge	5
40D*:					
Opal	Clayey	Favorable	2,600	Western wheatgrass	30
		Normal	2,200	Green needlegrass	25
		Unfavorable	1,500	Sideoats grama	10
				Blue grama	10
				Little bluestem	10
				Sedge	10
Sansarc	Shallow Clay	Favorable	2,500	Little bluestem	30
		Normal	2,100	Western wheatgrass	20
		Unfavorable	1,500	Green needlegrass	15
				Sideoats grama	10
				Big bluestem	10
				Blue grama	5
				Sedge	5
41A, 41B	Clayey	Favorable	3,000	Western wheatgrass	45
Promise		Normal	2,500	Green needlegrass	30
		Unfavorable	1,700	Sideoats grama	5
				Blue grama	5
				Little bluestem	5
				Sedge	5
41C*:					
Promise	Clayey	Favorable	2,900	Western wheatgrass	40
		Normal	2,400	Green needlegrass	30
		Unfavorable	1,700	Little bluestem	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
Opal	Clayey	Favorable	2,900	Western wheatgrass	40
		Normal	2,400	Green needlegrass	30
		Unfavorable	1,700	Blue grama	10
				Sideoats grama	5
				Little bluestem	5
				Sedge	5
51	Closed Depression	Favorable	4,600	Slim sedge	25
Tonka		Normal	4,200	Woolyfruit sedge	25
		Unfavorable	3,000	Prairie cordgrass	20
				Western wheatgrass	15
				Common spikesedge	5
				Northern reedgrass	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
52A, 52B---------- Lehr	Shallow to Gravel----------	Favorable	2,200	Needleandthread----------	35
		Normal	1,800	Blue grama----------	20
		Unfavorable	1,100	Little bluestem----------	10
				Sedge----------	10
				Plains muhly----------	5
53D*:					
Wabek----------	Very Shallow----------	Favorable	1,400	Needleandthread----------	35
		Normal	1,200	Blue grama----------	25
		Unfavorable	800	Threadleaf sedge----------	20
				Plains muhly----------	5
Lehr----------	Shallow to Gravel----------	Favorable	2,200	Needleandthread----------	35
		Normal	1,800	Blue grama----------	20
		Unfavorable	1,100	Little bluestem----------	10
				Sedge----------	10
				Plains muhly----------	5
53E---------- Wabek	Very Shallow----------	Favorable	1,400	Needleandthread----------	35
		Normal	1,200	Blue grama----------	25
		Unfavorable	800	Threadleaf sedge----------	20
				Plains muhly----------	5
54---------- Divide	Silty----------	Favorable	3,600	Green needlegrass----------	20
		Normal	3,000	Little bluestem----------	15
		Unfavorable	2,100	Needleandthread----------	15
				Big bluestem----------	10
				Sedge----------	10
				Western wheatgrass----------	5
56---------- Regan	Wetland----------	Favorable	6,600	Prairie cordgrass----------	60
		Normal	6,000	Sedge----------	15
		Unfavorable	4,800	Reedgrass----------	10
				Switchgrass----------	10
57A*:					
Williams----------	Silty----------	Favorable	3,200	Western wheatgrass----------	30
		Normal	2,700	Needleandthread----------	20
		Unfavorable	1,900	Green needlegrass----------	20
				Little bluestem----------	10
				Blue grama----------	10
				Sedge----------	5
				Big bluestem----------	5
Bowbells----------	Overflow----------	Favorable	4,300	Big bluestem----------	45
		Normal	3,600	Western wheatgrass----------	20
		Unfavorable	2,500	Green needlegrass----------	15
				Sideoats grama----------	5
				Leadplant----------	5
				Sedge----------	5
57B*:					
Williams----------	Silty----------	Favorable	3,000	Western wheatgrass----------	30
		Normal	2,250	Needleandthread----------	20
		Unfavorable	1,850	Green needlegrass----------	20
				Little bluestem----------	10
				Blue grama----------	10
				Sedge----------	5
Bowbells----------	Silty----------	Favorable	3,600	Needlegrass----------	50
		Normal	3,000	Western wheatgrass----------	15
		Unfavorable	2,100	Big bluestem----------	10
				Little bluestem----------	10
				Blue grama----------	5
				Sedge----------	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
57C*, 58B*:					
Williams	Silty	Favorable	3,000	Western wheatgrass	30
		Normal	2,500	Needleandthread	20
		Unfavorable	1,700	Green needlegrass	20
				Little bluestem	10
				Blue grama	10
				Sedge	5
Vida	Silty	Favorable	2,900	Green needlegrass	30
		Normal	2,400	Western wheatgrass	25
		Unfavorable	1,700	Needleandthread	20
				Little bluestem	5
				Sedge	5
				Blue grama	5
59D*:					
Vida	Silty	Favorable	2,900	Green needlegrass	30
		Normal	2,400	Western wheatgrass	25
		Unfavorable	1,700	Needleandthread	20
				Little bluestem	5
				Sedge	5
				Blue grama	5
Zahl	Thin Upland	Favorable	2,600	Little bluestem	30
		Normal	2,200	Needleandthread	15
		Unfavorable	1,200	Sideoats grama	15
				Western wheatgrass	10
				Plains muhly	5
				Blue grama	5
				Sedge	5
61E*:					
Zahl	Thin Upland	Favorable	2,600	Little bluestem	30
		Normal	2,200	Needleandthread	15
		Unfavorable	1,200	Western wheatgrass	10
				Sedge	5
				Sideoats grama	5
				Plains muhly	5
				Blue grama	5
Vida	Silty	Favorable	2,900	Green needlegrass	30
		Normal	2,400	Western wheatgrass	25
		Unfavorable	1,700	Needleandthread	20
				Little bluestem	5
				Sedge	5
				Blue grama	5
62	Silty	Favorable	2,900	Green needlegrass	30
Vida		Normal	2,400	Western wheatgrass	25
		Unfavorable	1,700	Needleandthread	25
				Blue grama	10
				Sedge	5
65B*, 65C*:					
Bryant	Silty	Favorable	3,400	Green needlegrass	50
		Normal	2,800	Western wheatgrass	20
		Unfavorable	2,000	Needleandthread	15
				Blue grama	5
				Sedge	5
Sutley	Thin Upland	Favorable	3,000	Little bluestem	25
		Normal	2,500	Needleandthread	25
		Unfavorable	1,700	Western wheatgrass	20
				Blue grama	15
				Sideoats grama	10
				Sedge	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
65D*:					
Sutley	Thin Upland	Favorable	2,800	Little bluestem	35
		Normal	2,300	Needleandthread	25
		Unfavorable	1,600	Sideoats grama	15
				Western wheatgrass	10
				Blue grama	10
				Sedge	5
Linton	Silty	Favorable	3,000	Green needlegrass	30
		Normal	2,500	Western wheatgrass	25
		Unfavorable	2,100	Needleandthread	15
				Blue grama	5
				Sedge	5
66 Arveson	Subirrigated	Favorable	5,000	Big bluestem	50
		Normal	4,600	Sedge	10
		Unfavorable	4,200	Switchgrass	10
				Indiangrass	10
				Prairie cordgrass	10
				Kentucky bluegrass	5
67A, 67B Farnuf	Silty	Favorable	2,520	Western wheatgrass	30
		Normal	2,100	Green needlegrass	25
		Unfavorable	1,470	Needleandthread	20
				Blue grama	10
				Little bluestem	5
				Sedge	5
68A*:					
Bryant	Silty	Favorable	3,400	Green needlegrass	50
		Normal	2,800	Western wheatgrass	20
		Unfavorable	2,000	Needleandthread	15
				Blue grama	5
				Sedge	5
Grassna	Overflow	Favorable	4,300	Big bluestem	45
		Normal	3,600	Western wheatgrass	20
		Unfavorable	2,500	Green needlegrass	15
				Sideoats grama	5
				Leadplant	5
				Sedge	5
68B, 68C Bryant	Silty	Favorable	3,400	Green needlegrass	50
		Normal	2,800	Western wheatgrass	20
		Unfavorable	2,000	Needleandthread	15
				Blue grama	5
				Sedge	5
71*:					
Ranslo	Subirrigated	Favorable	4,800	Big bluestem	60
		Normal	4,400	Switchgrass	10
		Unfavorable	3,500	Western wheatgrass	10
				Sedge	10
				Kentucky bluegrass	5
Harriet	Saline Lowland	Favorable	2,900	Western wheatgrass	30
		Normal	2,500	Inland saltgrass	25
		Unfavorable	2,100	Nuttall alkaligrass	15
				Cordgrass	15
				Bluegrass	10
72 Straw	Overflow	Favorable	4,800	Big bluestem	40
		Normal	4,000	Needlegrass	20
		Unfavorable	2,800	Western wheatgrass	15
				Kentucky bluegrass	10
				Little bluestem	5
				Sedge	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
74A, 74B---------- Savage	Clayey----------	Favorable	3,100	Western wheatgrass----------	45
		Normal	2,600	Green needlegrass----------	35
		Unfavorable	1,800	Blue grama----------	5
				Sedge----------	5
80---------- Ranslo	Subirrigated----------	Favorable	4,800	Big bluestem----------	60
		Normal	4,400	Switchgrass----------	10
		Unfavorable	3,500	Western wheatgrass----------	10
				Sedge----------	10
				Kentucky bluegrass----------	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
1A---------- Bowbells	---	Tatarian honeysuckle, Siberian crabapple, eastern redcedar, common chokecherry, Siberian peashrub, American plum, Peking cotoneaster.	Golden willow, ponderosa pine, Black Hills spruce, green ash.	---	Plains cottonwood.
2---------- Grail	---	Siberian crabapple, common chokecherry, eastern redcedar, Tatarian honeysuckle, Siberian peashrub, American plum, Peking cotoneaster.	Golden willow, ponderosa pine, Black Hills spruce, green ash.	---	Plains cottonwood.
4---------- Grassna	---	Tatarian honeysuckle, Siberian crabapple, eastern redcedar, common chokecherry, Siberian peashrub, American plum, Peking cotoneaster.	Golden willow, ponderosa pine, Black Hills spruce, green ash.	---	Plains cottonwood.
5*: Williams---------	---	Russian-olive, eastern redcedar, lilac, Siberian peashrub, common chokecherry, Tatarian honeysuckle, American plum.	Siberian crabapple, green ash, ponderosa pine, bur oak, Black Hills spruce.	---	---
Noonan----------	Green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry.	Siberian elm, ponderosa pine.	---	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
7A, 7B---------- Hamerly	---	Siberian crabapple, Tatarian honeysuckle, Peking cotoneaster, eastern redcedar, American plum, common chokecherry, Siberian peashrub.	Golden willow, green ash, ponderosa pine, Black Hills spruce.	---	Plains cottonwood.
9C---------- Seroco	---	Ponderosa pine, eastern redcedar, Rocky Mountain juniper.	---	---	---
9E*: Seroco.					
Dune land.					
10. Hurley					
11*: Hurley.					
Slickspots.					
13A, 13B, 13C----- Tally	Silver buffaloberry, lilac, Tatarian honeysuckle.	Bur oak, Siberian crabapple, common chokecherry, Siberian peashrub, eastern redcedar, American plum.	Green ash, ponderosa pine, Russian-olive.	---	---
15. Harriet					
16. Egas					
17---------- Hecla	---	Siberian crabapple, eastern redcedar, common chokecherry, Siberian peashrub, Tatarian honeysuckle, American plum, Peking cotoneaster.	Green ash, Black Hills spruce, ponderosa pine, golden willow.	---	Plains cottonwood.
18---------- Parshall	---	Siberian crabapple, common chokecherry, eastern redcedar, Peking cotoneaster, Siberian peashrub, Tatarian honeysuckle, American plum.	Golden willow, Black Hills spruce, green ash, ponderosa pine.	---	Plains cottonwood.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
19. Heil					
20D. Sully					
21A*: Linton	---	Russian-olive, Siberian peashrub, common chokecherry, eastern redcedar, Tatarian honeysuckle, American plum, lilac.	Siberian crabapple, Black Hills spruce, green ash, ponderosa pine, bur oak.	---	---
Grassna	---	Tatarian honeysuckle, Siberian crabapple, eastern redcedar, common chokecherry, Siberian peashrub, American plum, Peking cotoneaster.	Golden willow, ponderosa pine, Black Hills spruce, green ash.	---	Plains cottonwood.
21B Linton	---	Russian-olive, Siberian peashrub, common chokecherry, eastern redcedar, Tatarian honeysuckle, American plum, lilac.	Siberian crabapple, Black Hills spruce, green ash, ponderosa pine, bur oak.	---	---
21C*: Linton	---	Russian-olive, Siberian peashrub, common chokecherry, eastern redcedar, Tatarian honeysuckle, American plum, lilac.	Siberian crabapple, Black Hills spruce, green ash, ponderosa pine, bur oak.	---	---
Sutley	Tatarian honeysuckle, eastern redcedar, Siberian peashrub, Peking cotoneaster, American plum, lilac.	Ponderosa pine, Russian-olive, green ash, Rocky Mountain juniper.	Siberian elm	---	---
21D*: Sully. Zahl.					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
22B*: Linton	---	Russian-olive, Siberian peashrub, common chokecherry, eastern redcedar, Tatarian honeysuckle, American plum, lilac.	Siberian crabapple, Black Hills spruce, green ash, ponderosa pine, bur oak.	---	---
Sutley	Tatarian honeysuckle, eastern redcedar, Siberian peashrub, Peking cotoneaster, American plum, lilac.	Ponderosa pine, Russian-olive, green ash, Rocky Mountain juniper.	Siberian elm	---	---
22C Linton	---	Russian-olive, Siberian peashrub, common chokecherry, eastern redcedar, Tatarian honeysuckle, American plum, lilac.	Siberian crabapple, Black Hills spruce, green ash, ponderosa pine, bur oak.	---	---
24A Yecross	Silver buffaloberry, Tatarian honeysuckle, lilac.	Bur oak, Siberian crabapple, eastern redcedar, common chokecherry, Siberian peashrub, Tatarian honeysuckle, American plum.	Green ash, ponderosa pine, Russian-olive.	---	---
24C Yecross	---	Ponderosa pine, eastern redcedar, Rocky Mountain juniper.	---	---	---
27B Maddock	Silver buffaloberry, Tatarian honeysuckle, lilac.	Bur oak, common chokecherry, Siberian peashrub, eastern redcedar, American plum, Siberian crabapple.	Green ash, ponderosa pine, Russian-olive.	---	---
27C Maddock	---	Rocky Mountain juniper, eastern redcedar, ponderosa pine.	---	---	---

See footnote at end of table.

TABLF 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
28---------- Wyndmere	---	Siberian crabapple, American plum, Tatarian honeysuckle, eastern redcedar, Peking cotoneaster, common chokecherry, Siberian peashrub.	Golden willow, green ash, ponderosa pine, Black Hills spruce.	---	Plains cottonwood.
29---------- Vallers	Redosier dogwood, Siberian peashrub, Tatarian honeysuckle, American plum.	Black Hills spruce, Siberian crabapple, eastern redcedar, common chokecherry, lilac.	Green ash---------	Golden willow-----	Plains cottonwood.
30. Parnell					
31E. Lihen					
32F. Flasher					
34A, 34B---------- Bowdle	---	Ponderosa pine, green ash, Siberian peashrub, Rocky Mountain juniper, Russian-olive, eastern redcedar.	Siberian elm------	---	---
36B*: Lehr----------	---	Green ash, ponderosa pine, Russian-olive, Siberian peashrub, eastern redcedar, Rocky Mountain juniper.	Siberian elm------	---	---
Wabek.					
38. Parnell					
39E*: Sansarc.					
Opal.					
40B, 40C---------- Opal	Peking cotoneaster, lilac.	Siberian crabapple, common chokecherry, American plum, silver buffaloberry, Siberian peashrub.	Green ash, common hackberry, ponderosa pine, Russian-olive, eastern redcedar.	---	---
40D*: Opal.					
Sansarc.					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
41A, 41B---------- Promise	Peking cotoneaster, lilac.	Siberian crabapple, common chokecherry, American plum, silver buffaloberry, Siberian peashrub.	Green ash, common hackberry, ponderosa pine, Russian-olive, eastern redcedar.	---	---
41C*: Promise----------	Peking cotoneaster, lilac.	Siberian crabapple, common chokecherry, American plum, silver buffaloberry, Siberian peashrub.	Green ash, common hackberry, ponderosa pine, Russian-olive, eastern redcedar.	---	---
Opal----------	Peking cotoneaster, lilac.	Siberian crabapple, common chokecherry, American plum, silver buffaloberry, Siberian peashrub.	Green ash, common hackberry, ponderosa pine, Russian-olive, eastern redcedar.	---	---
51. Tonka					
52A, 52B---------- Lehr	---	Green ash, ponderosa pine, Russian-olive, Siberian peashrub, eastern redcedar, Rocky Mountain juniper.	Siberian elm------	---	---
53D*: Wabek.					
Lehr----------	---	Green ash, ponderosa pine, Russian-olive, Siberian peashrub, eastern redcedar, Rocky Mountain juniper.	Siberian elm------	---	---
53E. Wabek					
54---------- Divide	---	Siberian crabapple, Tatarian honeysuckle, Peking cotoneaster, eastern redcedar, American plum, common chokecherry, Siberian peashrub.	Golden willow, green ash, ponderosa pine, Black Hills spruce.	---	Plains cottonwood.
56. Regan					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
57A*: Williams	---	Russian-olive, eastern redcedar, lilac, Siberian peashrub, common chokecherry, Tatarian honeysuckle, American plum.	Siberian crabapple, green ash, ponderosa pine, bur oak, Black Hills spruce.	---	---
Bowbells	---	Tatarian honeysuckle, Siberian crabapple, eastern redcedar, common chokecherry, Siberian peashrub, American plum, Peking cotoneaster.	Golden willow, ponderosa pine, Black Hills spruce, green ash.	---	Plains cottonwood.
57B*: Williams	---	Russian-olive, eastern redcedar, lilac, Siberian peashrub, common chokecherry, Tatarian honeysuckle, American plum.	Siberian crabapple, green ash, ponderosa pine, bur oak, Black Hills spruce.	---	---
Bowbells	---	Siberian crabapple, Tatarian honeysuckle, Peking cotoneaster, eastern redcedar, American plum, common chokecherry, Siberian peashrub.	Golden willow, green ash, ponderosa pine, Black Hills spruce.	---	Plains cottonwood.
57C*, 58B*: Williams	---	Russian-olive, eastern redcedar, lilac, Siberian peashrub, common chokecherry, Tatarian honeysuckle, American plum.	Siberian crabapple, green ash, ponderosa pine, bur oak, Black Hills spruce.	---	---
Vida	---	Russian-olive, eastern redcedar, lilac, Siberian peashrub, common chokecherry, Tatarian honeysuckle, American plum.	Siberian crabapple, green ash, ponderosa pine, bur oak, Black Hills spruce.	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
59D*:					
Vida	---	Russian-olive, eastern redcedar, lilac, Siberian peashrub, common chokecherry, Tatarian honeysuckle, American plum.	Siberian crabapple, green ash, ponderosa pine, bur oak, Black Hills spruce.	---	---
Zahl.					
61E*:					
Zahl.					
Vida.					
62.					
Vida					
65B*, 65C*:					
Bryant	---	Bur oak, Russian-olive, eastern redcedar, common chokecherry, Siberian peashrub, American plum, Tatarian honeysuckle, lilac.	Black Hills spruce, ponderosa pine, green ash, Siberian crabapple.	---	---
Sutley	Tatarian honeysuckle, eastern redcedar, Siberian peashrub, Peking cotoneaster, American plum, lilac.	Ponderosa pine, Russian-olive, green ash, Rocky Mountain juniper.	Siberian elm	---	---
65D*:					
Sutley	Tatarian honeysuckle, eastern redcedar, Siberian peashrub, Peking cotoneaster, American plum, lilac.	Ponderosa pine, Russian-olive, green ash, Rocky Mountain juniper.	Siberian elm	---	---
Linton	---	Russian-olive, Siberian peashrub, common chokecherry, eastern redcedar, Tatarian honeysuckle, American plum, lilac.	Siberian crabapple, Black Hills spruce, green ash, ponderosa pine, bur oak.	---	---
66.					
Arveson					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
67A, 67B---------- Farnuf	---	Russian-olive, eastern redcedar, lilac, Siberian peashrub, common chokecherry, Tatarian honeysuckle, American plum.	Siberian crabapple, green ash, ponderosa pine, bur oak, Black Hills spruce.	---	---
68A*: Bryant----------	---	Bur oak, Russian-olive, eastern redcedar, common chokecherry, Siberian peashrub, American plum, Tatarian honeysuckle, lilac.	Black Hills spruce, ponderosa pine, green ash, Siberian crabapple.	---	---
Grassna----------	---	Tatarian honeysuckle, Siberian crabapple, eastern redcedar, common chokecherry, Siberian peashrub, American plum, Peking cotoneaster.	Golden willow, ponderosa pine, Black Hills spruce, green ash.	---	Plains cottonwood.
68B, 68C---------- Bryant	---	Bur oak, Russian-olive, eastern redcedar, common chokecherry, Siberian peashrub, American plum, Tatarian honeysuckle, lilac.	Black Hills spruce, ponderosa pine, green ash, Siberian crabapple.	---	---
71*: Ranslo---------- Harriet. 72. Straw	Siberian peashrub, American plum.	Black Hills spruce, Siberian crabapple, eastern redcedar, common chokecherry, lilac.	Blue spruce, green ash, ponderosa pine.	Golden willow-----	Plains cottonwood.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
74A, 74B---------- Savage	---	Russian-olive, eastern redcedar, lilac, Siberian peashrub, common chokecherry, Tatarian honeysuckle, American plum.	Siberian crabapple, green ash, ponderosa pine, bur oak, Black Hills spruce.	---	---
77*. Pits					
80---------- Ranslo	Siberian peashrub, American plum.	Black Hills spruce, Siberian crabapple, eastern redcedar, common chokecherry, lilac.	Blue spruce, green ash, ponderosa pine.	Golden willow-----	Plains cottonwood.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
1A---------- Bowbells	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
2---------- Grail	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
4---------- Grassna	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
5*: Williams----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Noonan----------	Poor	Poor	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
7A---------- Hamerly	Good	Good	Good	Good	Poor	Poor	Good	Poor	Good.
7B---------- Hamerly	Fair	Good	Good	Good	Very poor	Poor	Good	Very poor	Good.
9C---------- Seroco	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
9E*: Seroco----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Dune land.									
10---------- Hurley	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
11*: Hurley----------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Slickspots.									
13A, 13B---------- Tally	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
13C---------- Tally	Poor	Fair	Good	Fair	Very poor	Very poor	Poor	Very poor	Good.
15---------- Harriet	Very poor	Poor	Fair	Poor	Poor	Poor	Very poor	Poor	Fair.
16---------- Egas	Very poor	Very poor	Fair	Poor	Poor	Poor	Very poor	Poor	Fair.
17---------- Hecla	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Very poor	Good.
18---------- Parshall	Fair	Fair	Good	Good	Very poor	Very poor	Fair	Very poor	Good.
19---------- Heil	Very poor	Poor	Poor	Poor	Fair	Fair	Very poor	Fair	Poor.
20D---------- Sully	Very poor	Fair	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
21A*: Linton----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Grassna----------	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
21B---------- Linton	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
21C*:									
Linton----------	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Sutley----------	Fair	Fair	Fair	Poor	Very poor	Very poor	Fair	Very poor	Fair.
21D*:									
Sully----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Zahl----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
22B*:									
Linton----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Sutley----------	Good	Fair	Fair	Poor	Very poor	Very poor	Fair	Very poor	Fair.
22C---------- Linton	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
24A---------- Yecross	Poor	Fair	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
24C---------- Yecross	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
27B---------- Maddock	Poor	Fair	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
27C---------- Maddock	Very poor	Fair	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
28---------- Wyndmere	Fair	Fair	Good	Good	Very poor	Poor	Fair	Very poor	Good.
29---------- Vallers	Poor	Poor	Fair	Good	Fair	Fair	Poor	Fair	Fair.
30---------- Parnell	Very poor	Very poor	Very poor	Very poor	Good	Good	Very poor	Good	Very poor.
31E---------- Lihen	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.
32F---------- Flasher	Very poor	Very poor	Fair	Very poor	Very poor	Very poor	Very poor	Very poor	Fair.
34A, 34B---------- Bowdle	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
36B*:									
Lehr----------	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Wabek----------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
38---------- Parnell	Very poor	Poor	Fair	Poor	Fair	Fair	Very poor	Fair	Fair.
39E*:									
Sansarc----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Opal----------	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.
40B---------- Opal	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
40C---------- Opal	Poor	Fair	Good	Fair	Very poor	Very poor	Poor	Very poor	Good.
40D*:									
Opal----------	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.
Sansarc----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
41A, 41B---------- Promise	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
41C*:									
Promise----------	Poor	Fair	Good	Fair	Very poor	Very poor	Poor	Very poor	Good.
Opal----------	Poor	Fair	Good	Fair	Very poor	Very poor	Poor	Very poor	Good.
51---------- Tonka	Poor	Poor	Poor	Poor	Fair	Fair	Poor	Fair	Poor.
52A, 52B---------- Lehr	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
53D*:									
Wabek----------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Lehr----------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
53E---------- Wabek	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
54---------- Divide	Fair	Fair	Good	Good	Poor	Very poor	Fair	Very poor	Good.
56---------- Regan	Very Poor	Poor	Fair	Poor	Fair	Fair	Very poor	Fair	Fair.
57A*:									
Williams----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Bowbells----------	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
57B*:									
Williams----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Bowbells----------	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
57C*:									
Williams----------	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Vida----------	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
58B*:									
Williams----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Vida----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
59D*:									
Vida----------	Poor	Good	Good	Fair	Very poor	Very poor	Poor	Very poor	Good.
Zahl----------	Very poor	Fair	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
61E*:									
Zahl----------	Very poor	Fair	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Vida----------	Very poor	Good	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
62---------- Vida	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.
65B*:									
Bryant----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Sutley----------	Good	Fair	Fair	Poor	Very poor	Very poor	Fair	Very poor	Fair.
65C*:									
Bryant----------	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Sutley----------	Fair	Fair	Fair	Poor	Very poor	Very poor	Fair	Very poor	Fair.
65D*:									
Sutley----------	Poor	Fair	Fair	Poor	Very poor	Very poor	Poor	Very poor	Fair.
Linton----------	Poor	Good	Good	Poor	Very poor	Very poor	Poor	Very poor	Good.
66---------- Arveson	Very poor	Poor	Fair	Poor	Fair	Fair	Very poor	Fair	Fair.
67A, 67B---------- Farnuf	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
68A*:									
Bryant----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Grassna----------	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
68B---------- Bryant	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
68C---------- Bryant	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
71*:									
Ranslo----------	Fair	Good	Fair	Good	Fair	Fair	Fair	Fair	Fair.
Harriet----------	Very poor	Poor	Fair	Poor	Poor	Poor	Very poor	Poor	Fair.
72---------- Straw	Very poor	Good	Fair	Poor	Very poor	Poor	Poor	Very poor	Fair.
74A, 74B---------- Savage	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
77*. Pits									
80---------- Ranslo	Fair	Good	Fair	Good	Fair	Fair	Fair	Fair	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
1A---------- Bowbells	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
2---------- Grail	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
4---------- Grassna	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
5*: Williams----------	Slight----------	Slight----------	Slight----------	Slight.
Noonan----------	Slight----------	Slight----------	Slight----------	Slight.
7A---------- Hamerly	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Slight.
7B---------- Hamerly	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight.
9C---------- Seroco	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
9E*: Seroco----------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
Dune land.				
10---------- Hurley	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight.
11*: Hurley----------	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight.
Slickspots.				
13A---------- Tally	Slight----------	Slight----------	Slight----------	Slight.
13B---------- Tally	Slight----------	Slight----------	Moderate: slope.	Slight.
13C---------- Tally	Slight----------	Slight----------	Severe: slope.	Slight.
15---------- Harriet	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.	Severe: wetness.
16---------- Egas	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
17---------- Hecla	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
18---------- Parshall	Slight----------	Slight----------	Slight----------	Slight.
19---------- Heil	Severe: floods, wetness, percs slowly.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
20D---------- Sully	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
21A*:				
Linton----------	Slight----------	Slight----------	Slight----------	Slight.
Grassna----------	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
21B---------- Linton	Slight----------	Slight----------	Moderate: slope.	Slight.
21C*:				
Linton----------	Slight----------	Slight----------	Severe: slope.	Slight.
Sutley----------	Slight----------	Slight----------	Severe: slope.	Slight.
21D*:				
Sully----------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Zahl----------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
22B*:				
Linton----------	Slight----------	Slight----------	Moderate: slope.	Slight.
Sutley----------	Slight----------	Slight----------	Moderate: slope.	Slight.
22C---------- Linton	Slight----------	Slight----------	Severe: slope.	Slight.
24A---------- Yecross	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
24C---------- Yecross	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
27B---------- Maddock	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
27C---------- Maddock	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
28---------- Wyndmere	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight.
29---------- Vallers	Severe: wetness, floods.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
30--- Parnell	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.
31E--- Lihen	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
32F--- Flasher	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.
34A--- Bowdle	Slight	Slight	Slight	Slight.
34B--- Bowdle	Slight	Slight	Moderate: slope.	Slight.
36B*:				
Lehr	Slight	Slight	Moderate: slope.	Slight.
Wabek	Slight	Slight	Moderate: slope.	Slight.
38--- Parnell	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.
39E*:				
Sansarc	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, too clayey, depth to rock.	Severe: slope.
Opal	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Moderate: too clayey, slope.
40B--- Opal	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Severe: too clayey.	Moderate: too clayey.
40C--- Opal	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Severe: slope, too clayey.	Moderate: too clayey.
40D*:				
Opal	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey.	Severe: slope, too clayey.	Moderate: too clayey.
Sansarc	Severe: depth to rock.	Moderate: slope, too clayey.	Severe: slope, too clayey, depth to rock.	Moderate: too clayey.
41A, 41B--- Promise	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: too clayey.	Moderate: too clayey.
41C*:				
Promise	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: slope, too clayey.	Moderate: too clayey.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
41C*: Opal	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Severe: slope, too clayey.	Moderate: too clayey.
51 Tonka	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
52A Lehr	Slight	Slight	Slight	Slight.
52B Lehr	Slight	Slight	Moderate: slope.	Slight.
53D*: Wabek	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Lehr	Slight	Slight	Severe: slope.	Slight.
53E Wabek	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
54 Divide	Slight	Slight	Slight	Slight.
56 Regan	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
57A*: Williams	Slight	Slight	Slight	Slight.
Bowbells	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
57B*: Williams	Slight	Slight	Moderate: slope.	Slight.
Bowbells	Slight	Slight	Moderate: slope.	Slight.
57C*: Williams	Slight	Slight	Severe: slope.	Slight.
Vida	Slight	Slight	Severe: slope.	Slight.
58B*: Williams	Slight	Slight	Moderate: slope.	Slight.
Vida	Slight	Slight	Moderate: slope.	Slight.
59D*: Vida	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Zahl	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
61E*:				
Zahl	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Vida	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
62 Vida	Slight	Slight	Severe: slope.	Slight.
65B*:				
Bryant	Slight	Slight	Moderate: slope.	Slight.
Sutley	Slight	Slight	Moderate: slope.	Slight.
65C*:				
Bryant	Slight	Slight	Severe: slope.	Slight.
Sutley	Slight	Slight	Severe: slope.	Slight.
65D*:				
Sutley	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Linton	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
66 Arveson	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
67A Farnuf	Slight	Slight	Moderate: small stones.	Slight.
67B Farnuf	Slight	Slight	Moderate: slope.	Slight.
68A*:				
Bryant	Slight	Slight	Slight	Slight.
Grassna	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
68B Bryant	Slight	Slight	Moderate: slope.	Slight.
68C Bryant	Slight	Slight	Severe: slope.	Slight.
71*:				
Ranslo	Severe: floods.	Slight	Moderate: floods, percs slowly.	Slight.
Harriet	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.	Severe: wetness.
72 Straw	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
74A Savage	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
74B---------- Savage	Moderate: percs slowly.	Slight----------	Moderate: percs slowly, slope.	Slight.
77*. Pits				
80---------- Ranslo	Severe: floods.	Slight----------	Moderate: floods, percs slowly.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1A Bowbells	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.
2 Grail	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
4 Grassna	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
5*: Williams	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Noonan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
7A Hamerly	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.
7B Hamerly	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: frost action, low strength.
9C Seroco	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
9E*: Seroco	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Dune land.					
10 Hurley	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
11*: Hurley	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Slickspots.					
13A Tally	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
13B, 13C Tally	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.
15 Harriet	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, low strength.
16 Egas	Severe: wetness, floods.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, wetness, floods.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
17---- Hecla	Severe: cutbanks cave.	Slight----	Moderate: wetness.	Slight----	Moderate: frost action.
18---- Parshall	Slight----	Slight----	Slight----	Slight----	Moderate: frost action, low strength.
19---- Heil	Severe: too clayey, wetness, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, low strength.
20D---- Sully	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
21A*: Linton----	Slight----	Slight----	Slight----	Slight----	Moderate: low strength, frost action.
Grassna----	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
21B---- Linton	Slight----	Slight----	Slight----	Moderate: slope.	Moderate: low strength, frost action.
21C*: Linton----	Slight----	Slight----	Slight----	Moderate: slope.	Moderate: low strength, frost action.
Sutley----	Slight----	Slight----	Slight----	Moderate: slope.	Moderate: frost action, low strength.
21D*: Sully----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Zahl----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
22B*: Linton----	Slight----	Slight----	Slight----	Moderate: slope.	Moderate: low strength, frost action.
Sutley----	Slight----	Slight----	Slight----	Moderate: slope.	Moderate: frost action, low strength.
22C---- Linton	Slight----	Slight----	Slight----	Moderate: slope.	Moderate: low strength, frost action.
24A---- Yecross	Severe: cutbanks cave.	Slight----	Slight----	Slight----	Slight.
24C---- Yecross	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
27B---- Maddock	Severe: cutbanks cave.	Slight----	Slight----	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
27C---------- Maddock	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
28---------- Wyndmere	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.
29---------- Vallers	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, low strength.
30---------- Parnell	Severe: floods, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, wetness, floods.
31E---------- Lihen	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
32F---------- Flasher	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
34A---------- Bowdle	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight.
34B---------- Bowdle	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight.
36B*:					
Lehr----------	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight.
Wabek----------	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight.
38---------- Parnell	Severe: floods, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, low strength.
39E*:					
Sansarc----------	Severe: slope, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.
Opal----------	Severe: slope.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.
40B, 40C---------- Opal	Moderate: too clayey, depth to rock.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
40D*:					
Opal----------	Moderate: too clayey, depth to rock, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: shrink-swell, low strength.
Sansarc----------	Severe: depth to rock.	Severe: shrink-swell.	Severe: shrink-swell, depth to rock.	Severe: slope, shrink-swell.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
41A, 41B---------- Promise	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
41C*: Promise----------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Opal----------	Moderate: too clayey, depth to rock.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
51---------- Tonka	Severe: wetness, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, low strength.
52A---------- Lehr	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight.
52B---------- Lehr	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight.
53D*: Wabek----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Lehr----------	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight.
53E---------- Wabek	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
54---------- Divide	Severe: cutbanks cave.	Slight----------	Moderate: wetness.	Slight----------	Moderate: low strength.
56---------- Regan	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, low strength.
57A*: Williams---------	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Bowbells---------	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.
57B*: Williams---------	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Bowbells---------	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
57C*: Williams---------	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Vida----------	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
58B*: Williams	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Vida	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
59D*: Vida	Moderate: slope, too clayey.	Moderate: slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.
Zahl	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength.
61E*: Zahl	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Vida	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.
62 Vida	Moderate: too clayey, large stones.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, large stones.	Moderate: slope, shrink-swell.	Moderate: shrink-swell, frost action, low strength.
65B*, 65C*: Bryant	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Sutley	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action, low strength.
65D*: Sutley	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action, low strength.
Linton	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, frost action, slope.
66 Arveson	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: floods, wetness, frost action.
67A Farnuf	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
67B Farnuf	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
68A*:					
Bryant	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Grassna	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
68B, 68C Bryant	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
71*:					
Ranslo	Severe: floods.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, frost action, low strength.
Harriet	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, low strength.
72 Straw	Severe: floods, cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
74A, 74B Savage	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
77*. Pits					
80 Ranslo	Severe: floods.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, frost action, low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1A---------- Bowbells	Severe: floods, percs slowly.	Slight----------	Severe: floods.	Severe: floods.	Fair: too clayey.
2---------- Grail	Severe: percs slowly.	Slight----------	Moderate: too clayey.	Slight----------	Fair: too clayey.
4---------- Grassna	Severe: floods.	Moderate: seepage.	Severe: floods.	Severe: floods.	Good.
5*: Williams----------	Severe: percs slowly.	Slight----------	Moderate: too clayey.	Slight----------	Fair: too clayey.
Noonan----------	Severe: percs slowly.	Slight----------	Moderate: too clayey.	Slight----------	Poor: excess sodium.
7A, 7B---------- Hamerly	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
9C---------- Seroco	Slight----------	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy.
9E*: Seroco----------	Severe: slope.	Severe: seepage, slope.	Severe: too sandy, seepage.	Severe: seepage, slope.	Poor: too sandy, slope.
Dune land.					
10---------- Hurley	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey, area reclaim.
11*: Hurley----------	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey, area reclaim.
Slickspots.					
13A, 13B---------- Tally	Slight----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Fair: thin layer.
13C---------- Tally	Slight----------	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Fair: thin layer.
15---------- Harriet	Severe: percs slowly, wetness.	Slight----------	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness, excess sodium.
16---------- Egas	Severe: floods, wetness, percs slowly.	Severe: floods.	Severe: too clayey, wetness, floods.	Severe: floods, wetness.	Poor: too clayey, wetness.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
17--Hecla	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness, seepage, too sandy.	Severe: seepage, wetness.	Poor: too sandy.
18--Parshall	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
19--Heil	Severe: percs slowly, wetness, floods.	Slight	Severe: too clayey, wetness, floods.	Severe: floods, wetness.	Poor: too clayey, wetness, excess sodium.
20D--Sully	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
21A*:					
Linton	Slight	Moderate: seepage.	Slight	Slight	Good.
Grassna	Severe: floods.	Moderate: seepage.	Severe: floods.	Severe: floods.	Good.
21B--Linton	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
21C*:					
Linton	Slight	Severe: slope.	Slight	Slight	Good.
Sutley	Slight	Severe: slope.	Slight	Slight	Good.
21D*:					
Sully	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Zahl	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
22B*:					
Linton	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
Sutley	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
22C--Linton	Slight	Severe: slope.	Slight	Slight	Good.
24A--Yecross	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, too sandy.
24C--Yecross	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage, too sandy.
27B--Maddock	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
27C--- Maddock	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
28--- Wyndmere	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Fair: wetness.
29--- Vallers	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
30--- Parnell	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: wetness.
31E--- Lihen	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
32F--- Flasher	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: seepage, slope, depth to rock.	Poor: slope, area reclaim.
34A, 34B--- Bowdle	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy, seepage.
36B*: Lehr---	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Wabek---	Slight	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy, seepage.
38--- Parnell	Severe: floods, wetness, percs slowly.	Slight	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: wetness, too clayey.
39E*: Sansarc---	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: slope, too clayey, depth to rock.	Severe: slope, depth to rock.	Poor: slope, too clayey, area reclaim.
Opal---	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey, slope.	Severe: slope.	Poor: slope, too clayey, area reclaim.
40B--- Opal	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Moderate: depth to rock.	Poor: too clayey, area reclaim.
40C--- Opal	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Moderate: depth to rock.	Poor: too clayey, area reclaim.
40D*: Opal---	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Moderate: slope, depth to rock.	Poor: too clayey, area reclaim.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
40D*:					
Sansarc	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: too clayey, depth to rock.	Severe: depth to rock.	Poor: too clayey, area reclaim.
41A	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
41B	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
41C*:					
Promise	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Opal	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Moderate: depth to rock.	Poor: too clayey, area reclaim.
51 Tonka	Severe: wetness, floods, percs slowly.	Slight	Severe: wetness, floods, too clayey.	Severe: wetness, floods.	Poor: too clayey, wetness.
52A, 52B Lehr	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, too sandy, small stones.
53D*:					
Wabek	Moderate: slope.	Severe: seepage, slope.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy, seepage.
Lehr	Slight	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage, too sandy, small stones.
53E Wabek	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: too sandy, slope, seepage.
54 Divide	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy, small stones, seepage.
56 Regan	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
57A*:					
Williams	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Bowbells	Severe: floods, percs slowly.	Slight	Severe: floods.	Severe: floods.	Fair: too clayey.
57B*:					
Williams	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Bowbells	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
57C*: Williams	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Vida	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
58B*: Williams	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Vida	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
59D*: Vida	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: slope, too clayey.
Zahl	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
61E*: Zahl	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Vida	Severe: slope, percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Severe: slope.	Poor: slope.
62 Vida	Severe: percs slowly.	Severe: slope, large stones.	Moderate: too clayey, large stones.	Slight	Poor: large stones.
65B*: Bryant	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Good.
Sutley	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
65C*: Bryant	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Good.
Sutley	Slight	Severe: slope.	Slight	Slight	Good.
65D*: Sutley	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Linton	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
66 Arveson	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, seepage, floods.	Severe: wetness, floods.	Poor: wetness.
67A Farnuf	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Fair: too clayey.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
67B---------- Farnuf	Severe: percs slowly.	Moderate: slope, seepage.	Slight----------	Slight----------	Fair: too clayey.
68A*:					
Bryant----------	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight----------	Good.
Grassna----------	Severe: floods.	Moderate: seepage.	Severe: floods.	Severe: floods.	Good.
68B---------- Bryant	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight----------	Good.
68C---------- Bryant	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight----------	Good.
71*:					
Ranslo----------	Severe: percs slowly, floods, wetness.	Slight----------	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Harriet----------	Severe: percs slowly, wetness.	Slight----------	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness, excess sodium.
72---------- Straw	Severe: floods.	Severe: seepage, floods.	Severe: seepage, floods.	Severe: floods, seepage.	Good.
74A---------- Savage	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey.
74B---------- Savage	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey.
77*. Pits					
80---------- Ranslo	Severe: percs slowly, floods, wetness.	Slight----------	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1A Bowbells	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
2 Grail	Fair: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
4 Grassna	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
5*: Williams	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Noonan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess sodium.
7A, 7B Hamerly	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
9C Seroco	Good	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
9E*: Seroco	Fair: slope.	Poor: excess fines.	Unsuited: excess fines.	Poor: slope.
Dune land.				
10 Hurley	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess sodium, excess salt.
11*: Hurley	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess sodium, excess salt.
Slickspots.				
13A, 13B, 13C Tally	Good	Poor: excess fines.	Unsuited: excess fines.	Good.
15 Harriet	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, excess salt, excess sodium.
16 Egas	Poor: shrink-swell, wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess salt, wetness.
17 Hecla	Fair: wetness, low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
18 Parshall	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
19--- Heil	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, too clayey, excess salt.
20D--- Sully	Fair: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
21A*:				
Linton---	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Grassna---	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
21B--- Linton	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
21C*:				
Linton---	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Sutley---	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
21D*:				
Sully---	Fair: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Zahl---	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
22B*:				
Linton---	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Sutley---	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
22C--- Linton	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
24A, 24C--- Yecross	Good---	Fair: excess fines.	Poor: excess fines.	Poor: area reclaim, too sandy.
27B--- Maddock	Good---	Fair: excess fines.	Unsuited: excess fines.	Fair: too sandy.
27C--- Maddock	Good---	Fair: excess fines.	Unsuited: excess fines.	Fair: too sandy, slope.
28--- Wyndmere	Fair: wetness, low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
29--- Vallers	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
30--- Parnell	Poor: low strength, wetness, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
31E---- Lihen	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: slope, too sandy.
32F---- Flasher	Poor: slope, thin layer, area reclaim.	Poor: thin layer, excess fines.	Unsuited: excess fines.	Poor: slope, area reclaim.
34A, 34B---- Bowdle	Good----	Poor: excess fines.	Fair: excess fines.	Good.
36B*: Lehr----	Good----	Good----	Good----	Poor: area reclaim.
Wabek----	Good----	Good----	Good----	Poor: small stones, area reclaim.
38---- Parnell	Poor: wetness, low strength, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
39E*: Sansarc----	Poor: slope, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, too clayey, area reclaim.
Opal----	Poor: shrink-swell, low strength, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, too clayey.
40B, 40C---- Opal	Poor: shrink-swell, low strength, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
40D*: Opal----	Poor: shrink-swell, low strength, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Sansarc----	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, area reclaim.
41A, 41B---- Promise	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
41C*: Promise----	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Opal----	Poor: shrink-swell, low strength, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
51--- Tonka	Poor: wetness, low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
52A, 52B--- Lehr	Good	Good	Good	Poor: area reclaim.
53D*:				
Wabek	Good	Good	Good	Poor: small stones, area reclaim.
Lehr	Good	Good	Good	Poor: area reclaim.
53E--- Wabek	Fair: slope.	Good	Good	Poor: small stones, slope, area reclaim.
54--- Divide	Good	Fair: excess fines.	Fair: excess fines.	Fair: thin layer.
56--- Regan	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
57A*:				
Williams	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Bowbells	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
57B*:				
Williams	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Bowbells	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
57C*, 58B*:				
Williams	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Vida	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess sodium.
59D*:				
Vida	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess sodium.
Zahl	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, too clayey.
61E*:				
Zahl	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Vida	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, excess sodium.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
62--- Vida	Fair: shrink-swell, frost action, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
65B*, 65C*: Bryant---	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Sutley---	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
65D*: Sutley---	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
Linton---	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
66--- Arveson	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: wetness.
67A, 67B--- Farnuf	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
68A*: Bryant---	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Grassna---	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
68B, 68C--- Bryant	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
71*: Ranslo---	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess sodium.
Harriet---	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, excess salt, excess sodium.
72--- Straw	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
74A, 74B--- Savage	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
77*. Pits				
80--- Ranslo	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess sodium.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1A---------- Bowbells	Favorable------	Favorable------	Floods, frost action.	Floods---------	Not needed-----	Favorable.
2---------- Grail	Favorable------	Hard to pack---	Not needed-----	Slow intake----	Not needed-----	Favorable.
4---------- Grassna	Seepage--------	Piping---------	Not needed-----	Floods---------	Not needed-----	Favorable.
5*: Williams---------	Favorable------	Favorable------	Not needed-----	Favorable------	Favorable------	Erodes easily.
Noonan----------	Favorable------	Piping---------	Not needed-----	Percs slowly, excess sodium.	Percs slowly---	Excess sodium, percs slowly.
7A, 7B---------- Hamerly	Seepage--------	Wetness--------	Frost action---	Wetness--------	Wetness, erodes easily.	Erodes easily.
9C---------- Seroco	Slope, seepage.	Piping, seepage.	Not needed-----	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
9E*: Seroco----------	Slope, seepage.	Piping, seepage.	Not needed-----	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Dune land.						
10---------- Hurley	Favorable------	Hard to pack, piping.	Not needed-----	Percs slowly, excess sodium, droughty.	Percs slowly, erodes easily.	Excess salt, excess sodium.
11*: Hurley----------	Favorable------	Hard to pack, piping.	Not needed-----	Percs slowly, excess sodium, droughty.	Percs slowly, erodes easily.	Excess salt, excess sodium.
Slickspots.						
13A---------- Tally	Seepage--------	Piping---------	Not needed-----	Soil blowing---	Soil blowing---	Favorable.
13B, 13C---------- Tally	Seepage, slope.	Piping---------	Not needed-----	Slope, soil blowing.	Soil blowing---	Favorable.
15---------- Harriet	Favorable------	Wetness, piping.	Floods, percs slowly, frost action.	Wetness, percs slowly, excess sodium.	Not needed-----	Wetness, excess salt, excess sodium.
16---------- Egas	Favorable------	Hard to pack, piping, excess salt.	Percs slowly, floods, frost action.	Floods, percs slowly.	Not needed-----	Excess salt, wetness, excess sodium.
17---------- Hecla	Seepage--------	Seepage--------	Not needed-----	Fast intake, soil blowing.	Too sandy, soil blowing.	Favorable.
18---------- Parshall	Seepage--------	Seepage, piping.	Not needed-----	Soil blowing---	Soil blowing---	Favorable.
19---------- Heil	Favorable------	Hard to pack, piping.	Floods, percs slowly, excess salt.	Slow intake, percs slowly, floods.	Not needed-----	Excess salt, excess sodium, wetness.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
20D---------- Sully	Slope, seepage.	Piping---------	Not needed-----	Slope, erodes easily.	Erodes easily, slope.	Slope, erodes easily.
21A*:						
Linton----------	Seepage--------	Piping---------	Not needed-----	Favorable------	Favorable------	Favorable.
Grassna----------	Seepage--------	Piping---------	Not needed-----	Floods---------	Not needed-----	Favorable.
21B---------- Linton	Seepage, slope.	Piping---------	Not needed-----	Favorable------	Favorable------	Favorable.
21C*:						
Linton----------	Seepage, slope.	Piping---------	Not needed-----	Slope----------	Favorable------	Erodes easily.
Sutley----------	Seepage, slope.	Piping---------	Not needed-----	Slope----------	Erodes easily	Erodes easily.
21D*:						
Sully----------	Slope, seepage.	Piping---------	Not needed-----	Slope, erodes easily.	Erodes easily, slope.	Slope, erodes easily.
Zahl----------	Slope----------	Favorable------	Not needed-----	Percs slowly, slope.	Slope, percs slowly, erodes easily.	Slope, erodes easily, percs slowly.
22B*:						
Linton----------	Seepage, slope.	Piping---------	Not needed-----	Favorable------	Favorable------	Favorable.
Sutley----------	Seepage, slope.	Piping---------	Not needed-----	Favorable------	Erodes easily	Erodes easily.
22C---------- Linton	Seepage, slope.	Piping---------	Not needed-----	Slope----------	Favorable------	Favorable.
24A---------- Yecross	Seepage, slope.	Seepage--------	Not needed-----	Fast intake, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
24C---------- Yecross	Seepage, slope.	Seepage--------	Not needed-----	Fast intake, droughty, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
27B---------- Maddock	Seepage--------	Seepage, piping.	Not needed-----	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
27C---------- Maddock	Slope, seepage.	Seepage, piping.	Not needed-----	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Slope, droughty.
28---------- Wyndmere	Seepage--------	Seepage, piping.	Frost action---	Wetness, soil blowing.	Wetness, soil blowing.	Favorable.
29---------- Vallers	Favorable------	Wetness--------	Frost action---	Wetness--------	Wetness--------	Wetness.
30---------- Parnell	Favorable------	Hard to pack, wetness.	Percs slowly, floods, frost action.	Wetness, slow intake, floods.	Not needed-----	Wetness, percs slowly.
31E---------- Lihen	Seepage, slope.	Piping---------	Not needed-----	Slope, droughty, fast intake.	Too sandy, soil blowing, slope.	Slope, droughty.
32F---------- Flasher	Slope, depth to rock, seepage.	Thin layer, seepage.	Not needed-----	Droughty, rooting depth, slope.	Slope, depth to rock, too sandy.	Slope, depth to rock, rooting depth.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
34A---- Bowdle	Seepage----	Seepage, piping.	Not needed----	Favorable----	Too sandy----	Favorable.
34B---- Bowdle	Seepage, slope.	Seepage, piping.	Not needed----	Favorable----	Too sandy----	Favorable.
36B*:						
Lehr----	Seepage----	Seepage----	Not needed----	Droughty, slope.	Too sandy----	Droughty.
Wabek----	Seepage----	Seepage----	Not needed----	Droughty, slope.	Too sandy----	Droughty.
38---- Parnell	Favorable----	Hard to pack, wetness.	Floods, percs slowly, frost action.	Wetness, slow intake, percs slowly.	Not needed----	Wetness, percs slowly.
39E*:						
Sansarc----	Depth to rock, slope.	Thin layer, hard to pack.	Not needed----	Slope, slow intake, rooting depth.	Slope, depth to rock.	Slope, rooting depth, droughty.
Opal----	Slope, depth to rock.	Hard to pack, thin layer.	Not needed----	Slow intake, percs slowly, rooting depth.	Slope, percs slowly, depth to rock.	Slope, percs slowly, depth to rock.
40B---- Opal	Slope, depth to rock.	Hard to pack, thin layer.	Not needed----	Slow intake, percs slowly, rooting depth.	Percs slowly, depth to rock.	Percs slowly, depth to rock.
40C---- Opal	Slope, depth to rock.	Hard to pack, thin layer.	Not needed----	Slow intake, percs slowly, rooting depth.	Percs slowly, depth to rock.	Percs slowly, depth to rock.
40D*:						
Opal----	Slope, depth to rock.	Hard to pack, thin layer.	Not needed----	Slow intake, percs slowly, rooting depth.	Slope, percs slowly, depth to rock.	Slope, percs slowly, depth to rock.
Sansarc----	Depth to rock, slope.	Thin layer, hard to pack.	Not needed----	Slope, slow intake, rooting depth.	Slope, depth to rock.	Slope, rooting depth, droughty.
41A---- Promise	Favorable----	Hard to pack---	Not needed----	Slow intake, percs slowly.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
41B---- Promise	Slope----	Hard to pack---	Not needed----	Slope, slow intake, percs slowly.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
41C*:						
Promise----	Slope----	Hard to pack---	Not needed----	Slope, slow intake, percs slowly.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Opal----	Slope, depth to rock.	Hard to pack, thin layer.	Not needed----	Slow intake, percs slowly, rooting depth.	Percs slowly, depth to rock.	Percs slowly, depth to rock.
51---- Tonka	Favorable----	Hard to pack, wetness.	Frost action, percs slowly, floods.	Wetness, percs slowly, floods.	Not needed----	Wetness, percs slowly.
52A, 52B---- Lehr	Seepage----	Seepage----	Not needed----	Droughty----	Too sandy----	Droughty.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
53D*:						
Wabek	Slope, seepage.	Seepage	Not needed	Droughty, slope.	Slope, too sandy.	Slope, droughty.
Lehr	Slope, seepage.	Seepage	Not needed	Droughty, slope.	Too sandy	Droughty.
53E	Slope, seepage.	Seepage	Not needed	Droughty, slope.	Slope, too sandy.	Slope, droughty.
Wabek						
54	Seepage	Seepage	Favorable	Wetness	Not needed	Favorable.
Divide						
56	Seepage	Wetness	Floods, frost action.	Floods, wetness.	Not needed	Wetness.
Regan						
57A*:						
Williams	Favorable	Favorable	Not needed	Favorable	Favorable	Erodes easily.
Bowbells	Favorable	Favorable	Floods, frost action.	Floods	Not needed	Favorable.
57B*:						
Williams	Slope	Favorable	Not needed	Favorable	Favorable	Erodes easily.
Bowbells	Favorable	Favorable	Not needed	Favorable	Favorable	Erodes easily.
57C*:						
Williams	Slope	Favorable	Not needed	Slope	Favorable	Erodes easily.
Vida	Slope	Favorable	Not needed	Percs slowly, slope.	Percs slowly	Erodes easily.
58B*:						
Williams	Slope	Favorable	Not needed	Slope	Favorable	Erodes easily.
Vida	Favorable	Favorable	Not needed	Percs slowly, slope.	Percs slowly	Erodes easily.
59D*:						
Vida	Slope	Favorable	Not needed	Percs slowly, slope.	Slope, percs slowly.	Slope, erodes easily.
Zahl	Slope	Favorable	Not needed	Percs slowly, slope.	Slope, percs slowly.	Slope, erodes easily, percs slowly.
61E*:						
Zahl	Slope	Favorable	Not needed	Percs slowly, slope.	Slope, percs slowly.	Slope, erodes easily, percs slowly.
Vida	Slope	Piping	Not needed	Percs slowly, slope.	Slope, percs slowly.	Slope, erodes easily.
62	Slope	Large stones	Not needed	Large stones	Percs slowly, large stones.	Large stones.
Vida						
65B*:						
Bryant	Slope, seepage.	Piping	Not needed	Favorable	Erodes easily	Erodes easily.
Sutley	Seepage, slope.	Piping	Not needed	Favorable	Erodes easily	Erodes easily.
65C*:						
Bryant	Slope, seepage.	Piping	Not needed	Slope	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
65C*: Sutley	Seepage, slope.	Piping	Not needed	Slope	Erodes easily	Erodes easily.
65D*: Sutley	Seepage, slope.	Piping	Not needed	Slope	Erodes easily, slope.	Slope, erodes easily.
Linton	Seepage, slope.	Piping	Not needed	Slope	Slope	Slope.
66--- Arveson	Seepage	Seepage, wetness.	Floods, frost action.	Wetness, floods.	Not needed	Wetness.
67A--- Farnuf	Seepage	Favorable	Not needed	Favorable	Favorable	Favorable.
67B--- Farnuf	Slope, seepage.	Favorable	Not needed	Favorable	Favorable	Slope.
68A*: Bryant	Seepage	Piping	Not needed	Favorable	Erodes easily	Erodes easily.
Grassna	Seepage	Piping	Not needed	Floods	Not needed	Favorable.
68B--- Bryant	Slope, seepage.	Piping	Not needed	Favorable	Erodes easily	Erodes easily.
68C--- Bryant	Slope, seepage.	Piping	Not needed	Slope	Erodes easily	Erodes easily.
71*: Ranslo	Favorable	Hard to pack, piping, wetness.	Percs slowly, excess sodium.	Percs slowly, floods, erodes easily.	Wetness, percs slowly.	Excess sodium, percs slowly.
Harriet	Favorable	Wetness, piping.	Floods, percs slowly, frost action.	Wetness, percs slowly, excess sodium.	Not needed	Wetness, excess salt, excess sodium.
72--- Straw	Seepage	Seepage	Floods	Floods	Favorable	Favorable.
74A--- Savage	Favorable	Hard to pack	Percs slowly	Percs slowly, slow intake.	Percs slowly	Percs slowly, erodes easily.
74B--- Savage	Slope	Hard to pack	Slope, percs slowly.	Percs slowly, slow intake.	Percs slowly	Percs slowly, slope, erodes easily.
77*. Pits						
80--- Ranslo	Favorable	Hard to pack, piping, wetness.	Percs slowly, excess sodium.	Percs slowly, floods, erodes easily.	Wetness, percs slowly.	Excess sodium, percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1A---------- Bowbells	0-8	Loam----------	CL, ML, CL-ML	A-4, A-6	0-5	95-100	90-100	85-95	60-90	25-40	5-15
	8-23	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-95	60-80	30-45	10-20
	23-60	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-95	60-80	30-45	10-20
2---------- Grail	0-6	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	20-45	10-30
	6-38	Silty clay loam, silty clay.	CL	A-7	0	100	100	95-100	90-95	40-50	20-30
	38-60	Loam, silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	85-100	60-95	20-50	3-30
4---------- Grassna	0-26	Silt loam-------	CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	70-90	25-45	5-20
	26-60	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	70-95	25-45	5-20
5*:											
Williams----------	0-6	Loam----------	CL, ML	A-4, A-6, A-7	0-5	95-100	95-100	85-95	60-90	25-45	3-20
	6-25	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	60-80	30-50	10-30
	25-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	60-80	30-50	10-30
Noonan----------	0-9	Loam----------	CL, CL-ML	A-4, A-6	0-5	95-100	95-100	80-95	55-75	20-40	5-25
	9-19	Clay loam-------	CL, CH	A-6, A-7	0-5	95-100	95-100	85-95	65-80	25-60	10-35
	19-60	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	95-100	80-95	60-80	25-50	5-25
7A, 7B---------- Hamerly	0-11	Silt loam-------	CL, CL-ML	A-4, A-6	0-5	95-100	90-100	80-95	60-90	20-40	5-25
	11-23	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	90-100	80-95	60-75	20-45	5-25
	23-60	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	90-100	80-95	60-75	20-45	5-25
9C---------- Seroco	0-3	Loamy fine sand	SM, SP, SP-SM	A-2	0	100	100	50-75	2-30	<25	NP
	3-60	Fine sand, loamy fine sand, loamy sand.	SM, SP, SP-SM	A-2, A-3	0	100	100	65-90	2-35	<25	NP
9E*:											
Seroco----------	0-3	Loamy fine sand	SM, SP, SP-SM	A-2	0	100	100	50-75	2-30	<25	NP
	3-60	Fine sand, loamy fine sand, loamy sand.	SM, SP, SP-SM	A-2, A-3	0	100	100	65-90	2-35	<25	NP
Dune land.											
10---------- Hurley	0-2	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	2-60	Clay, shaly clay	CH, MH	A-7	0	100	100	95-100	80-100	50-90	20-55
11*:											
Hurley----------	0-2	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	2-60	Clay, shaly clay	CH, MH	A-7	0	100	100	95-100	80-100	50-90	20-55
Slickspots.											
13A, 13B, 13C------ Tally	0-7	Fine sandy loam	SM, ML, SM-SC	A-4	0	100	100	70-100	40-55	<25	NP-7
	7-42	Fine sandy loam, sandy loam.	SM, ML, SM-SC	A-4, A-2	0	100	100	65-100	20-55	<22	NP-7
	42-60	Loamy fine sand, fine sand.	SM, SM-SC	A-2	0	100	100	55-100	15-35	<25	NP-7

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
15---------- Harriet	0-2	Silt loam-------	CL, CL-ML	A-4, A-6, A-7	0	100	100	85-100	60-90	25-45	5-20
	2-60	Clay, silty clay loam, silty clay.	CL, CH	A-7, A-6	0	100	100	90-100	70-95	35-70	15-50
16---------- Egas	0-24	Silty clay loam	CH, MH	A-7	0	100	100	95-100	90-100	50-90	22-50
	24-60	Silty clay, silty clay loam, clay.	CH, MH	A-7	0	100	100	90-100	85-100	50-90	22-50
17---------- Hecla	0-16	Loamy sand------	SM, SM-SC	A-2	0	100	95-100	85-100	12-35	15-30	NP-7
	16-23	Loamy sand, loamy fine sand, fine sand.	SM, SM-SC	A-2	0	100	95-100	85-100	12-35	15-30	NP-5
	23-60	Loamy sand, fine sand, loamy fine sand.	SM, SM-SC	A-2	0	100	95-100	85-100	10-35	15-30	NP-5
18---------- Parshall	0-11	Fine sandy loam	SM, ML	A-4, A-2	0	100	100	60-85	30-55	---	NP
	11-60	Fine sandy loam, sandy loam, loamy fine sand.	SM, ML	A-4, A-2	0	100	100	60-85	30-55	---	NP
19---------- Heil	0-1	Silt loam-------	CL	A-6, A-7	0	100	100	90-100	70-95	20-50	10-30
	1-60	Silty clay, clay, silty clay loam.	CH	A-7	0	100	100	90-100	75-95	50-70	25-45
20D---------- Sully	0-3	Silt loam-------	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	3-15
	3-60	Silt loam, very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	90-100	85-100	20-40	5-15
21A*: Linton----------	0-60	Silt loam-------	ML	A-4	0	100	100	90-100	70-90	20-40	NP-10
Grassna----------	0-26	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	70-90	25-45	5-20
	26-60	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	70-95	25-45	5-20
21B---------- Linton	0-60	Silt loam-------	ML	A-4	0	100	100	90-100	70-90	20-40	NP-10
21C*: Linton----------	0-60	Silt loam-------	ML	A-4	0	100	100	90-100	70-90	20-40	NP-10
Sutley----------	0-6	Silt loam-------	ML, CL-ML	A-4	0	100	100	90-100	70-100	25-35	5-10
	6-60	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	90-100	70-100	20-35	NP-8
21D*: Sully----------	0-3	Silt loam-------	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	3-15
	3-60	Silt loam, very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	90-100	85-100	20-40	5-15
Zahl----------	0-5	Loam----------	CL	A-6	0-5	95-100	95-100	80-95	55-75	25-40	10-20
	5-60	Clay loam, loam	CL	A-6	0-5	95-100	95-100	80-95	60-80	25-40	10-20

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
22B*:											
Linton	0-60	Silt loam	ML	A-4	0	100	100	90-100	70-90	20-40	NP-10
Sutley	0-6	Silt loam	ML, CL-ML	A-4	0	100	100	90-100	70-100	25-35	5-10
	6-60	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	90-100	70-100	20-35	NP-8
22C	0-60	Silt loam	ML	A-4	0	100	100	90-100	70-90	20-40	NP-10
Linton											
24A, 24C	0-8	Loamy sand	SM, SM-SC	A-2	0	100	95-100	60-80	15-35	<25	NP-5
Yecross	8-60	Sand, loamy sand, gravelly sand.	SM, SW-SM, SM-SC, SP-SM	A-1, A-2, A-3	0-5	95-100	75-100	35-70	5-30	<25	NP-5
27B, 27C	0-15	Loamy fine sand	SM	A-2	0	100	100	50-80	15-35	---	NP
Maddock	15-60	Loamy sand, loamy fine sand, fine sand.	SM, SP-SM	A-2, A-3	0	100	95-100	60-95	5-35	---	NP
28	0-13	Fine sandy loam	SM, ML	A-2, A-4	0	100	100	60-80	30-55	---	NP
Wyndmere	13-40	Sandy loam, fine sandy loam.	SM, ML	A-2, A-4	0	100	100	60-80	30-55	---	NP
	40-60	Fine sand, loamy fine sand, fine sandy loam.	SM, ML	A-2, A-4	0	100	100	60-85	20-55	---	NP
29	0-9	Loam	OL, ML	A-4	0	95-100	90-100	80-90	65-80	30-40	4-10
Vallers	9-29	Clay loam, silty clay loam.	CL	A-6	0	95-100	90-97	90-95	70-80	30-40	11-20
	29-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	95-100	90-97	85-95	60-75	20-40	5-20
30	0-16	Silty clay loam	CL, CH	A-7	0	100	100	95-100	85-95	40-60	15-30
Parnell	16-60	Clay loam, silty clay loam, silty clay.	CH, MH	A-7	0	100	95-100	90-100	70-95	50-80	20-45
31E	0-20	Loamy fine sand	SM	A-2	0	100	85-100	45-75	15-30	---	NP
Lihen	20-32	Loamy fine sand, loamy sand, fine sand.	SM	A-2	0	100	85-100	45-75	15-35	---	NP
	32-60	Sandy loam, loamy fine sand, loamy sand.	SM	A-2, A-4	0	100	85-100	45-75	20-40	---	NP
32F	0-5	Loamy fine sand	SM	A-2	0-5	100	95-100	50-80	15-35	---	NP
Flasher	5-18	Loamy sand, loamy fine sand, fine sand.	SM	A-2	0-5	100	95-100	50-80	15-35	---	NP
	18-60	Weathered bedrock.									
34A, 34B	0-6	Loam	ML, CL	A-6, A-4	0	100	95-100	85-95	55-80	30-40	8-15
Bowdle	6-25	Loam, clay loam	CL, CL	A-4, A-6	0	95-100	95-100	80-95	55-75	30-40	8-15
	25-60	Sand and gravel	SM, SW-SM	A-1, A-2	0-5	60-95	50-85	25-50	5-30	<30	NP-5
36B*:											
Lehr	0-5	Loam	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-95	60-80	20-40	3-15
	5-17	Loam, clay loam	SC, CL, CL-ML	A-4, A-6	0-5	95-100	90-100	75-95	40-75	25-40	5-15
	17-60	Sand and gravel	SM, SM-SC GM, GP	A-1, A-2	0-5	40-95	50-90	20-70	5-25	<30	NP-7

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
36B*:											
Wabek	0-6	Loam	ML	A-4	0-1	90-100	90-100	75-90	50-70	25-40	NP-10
	6-10	Gravelly sandy loam, gravelly loam, gravelly coarse sandy loam.	SM, GM, SM-SC	A-2, A-4	0-5	50-100	50-95	50-65	20-40	<30	NP-7
	10-60	Very gravelly coarse sand, gravelly loamy coarse sand, sand.	SM, SP, GM, GP	A-1, A-2	0-5	50-100	50-95	10-40	2-35	<30	NP-7
38	0-16	Silty clay loam	CL, CH	A-7	0	100	100	95-100	85-95	40-60	15-30
Parnell	16-60	Clay loam, silty clay loam, silty clay.	CL, CH	A-7	0	100	95-100	90-100	70-95	40-80	20-50
39E*:											
Sansarc	0-4	Clay	CH, MH	A-7	0	100	95-100	90-100	75-100	50-90	20-55
	4-11	Shaly clay, very shaly clay, clay.	CH, MH	A-7	0	80-100	75-100	75-100	75-100	50-90	20-55
	11-60	Weathered bedrock.									
Opal	0-5	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	5-25	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	25-31	Clay, shaly clay	CH	A-7	0	100	95-100	90-100	80-100	50-85	25-60
	31-60	Weathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	50-95	25-65
40B, 40C	0-5	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
Opal	5-25	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	25-31	Clay, shaly clay	CH	A-7	0	100	95-100	90-100	80-100	50-85	25-60
	31-60	Weathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	50-95	25-65
40D*:											
Opal	0-5	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	5-25	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	25-31	Clay, shaly clay	CH	A-7	0	100	95-100	90-100	80-100	50-85	25-60
	31-60	Weathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	50-95	25-65
Sansarc	0-4	Clay	CH, MH	A-7	0	100	95-100	90-100	75-100	50-90	20-55
	4-11	Shaly clay, very shaly clay, clay.	CH, MH	A-7	0	80-100	75-100	75-100	75-100	50-90	20-55
	11-60	Weathered bedrock.									
41A, 41B	0-6	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-70	20-40
Promise	6-24	Clay	CH, MH	A-7	0	100	100	90-100	85-100	50-85	20-50
	24-60	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	85-100	50-85	25-55
41C*:											
Promise	0-6	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-70	20-40
	6-24	Clay	CH, MH	A-7	0	100	100	90-100	85-100	50-85	20-50
	24-60	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	85-100	50-85	25-55
Opal	0-5	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	5-25	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	25-31	Clay, shaly clay	CH	A-7	0	100	95-100	90-100	80-100	50-85	25-60
	31-60	Weathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	50-95	25-65

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
51---------- Tonka	0-15	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	95-100	90-100	70-90	20-40	5-25
	15-60	Silty clay loam, clay loam, silty clay.	CH, CL	A-6, A-7	0	100	95-100	90-100	75-95	35-55	15-35
52A, 52B---------- Lehr	0-5	Loam----------	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-95	60-80	20-40	3-15
	5-17	Loam, clay loam	SC, CL, CL-ML	A-4, A-6	0-5	95-100	90-100	75-95	40-75	25-40	5-15
	17-60	Sand and gravel	SM, SM-SC GM, GP	A-1, A-2	0-5	40-95	50-90	20-70	5-25	<30	NP-7
53D*: Wabek----------	0-6	Loam----------	ML	A-4	0-1	90-100	90-100	75-90	50-70	25-40	NP-10
	6-10	Gravelly sandy loam, gravelly loam, gravelly coarse sandy loam.	SM, GM, SM-SC	A-2, A-4	0-5	50-100	50-95	50-65	20-40	<30	NP-7
	10-60	Very gravelly coarse sand, gravelly loamy coarse sand, sand.	SM, SP, GM, GP	A-1, A-2	0-5	50-100	50-95	10-40	2-35	<30	NP-7
Lehr----------	0-5	Loam----------	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-95	60-80	20-40	3-15
	5-17	Loam, clay loam	SC, CL CL-ML	A-4, A-6	0-5	95-100	90-100	75-95	40-75	25-40	5-15
	17-60	Sand and gravel	SM, SM-SC GM, GP	A-1, A-2	0-5	40-95	50-90	20-70	5-25	<30	NP-7
53E---------- Wabek	0-6	Loam----------	ML	A-4	0-1	90-100	90-100	75-90	50-70	25-40	NP-10
	6-10	Gravelly sandy loam, gravelly loam, gravelly coarse sandy loam.	SM, GM, SM-SC	A-2, A-4	0-5	50-100	50-95	50-65	20-40	<30	NP-7
	10-60	Very gravelly coarse sand, gravelly loamy coarse sand, sand.	SM, SP, GM, GP	A-1, A-2	0-5	50-100	50-95	10-40	2-35	<30	NP-7
54---------- Divide	0-10	Loam----------	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-95	60-85	25-40	5-20
	10-25	Loam, clay loam, gravelly loam.	CL, CL-ML	A-4, A-6	0	95-100	80-100	60-90	55-80	25-40	5-20
	25-60	Stratified sand to gravelly sand.	GM, SM, GP-GM, SP-SM	A-1	0-5	25-75	15-65	10-40	5-25	---	NP
56---------- Regan	0-15	Silt loam-------	CL, CL-ML	A-7, A-6, A-4	0	100	100	90-100	80-95	20-50	5-30
	15-60	Stratified sandy loam to silty clay loam.	ML, CL, SC, SM	A-7, A-6, A-4	0	100	100	65-100	35-95	15-50	NP-30
57A*, 57B*: Williams----------	0-6	Loam----------	CL, ML	A-4, A-6, A-7	0-5	95-100	95-100	85-95	60-90	25-45	3-20
	6-25	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	60-80	30-50	10-30
	25-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	60-80	30-50	10-30
Bowbells----------	0-8	Loam----------	CL, ML, CL-ML	A-4, A-6	0-5	95-100	90-100	85-95	60-90	25-40	5-15
	8-23	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-95	60-80	30-45	10-20
	23-60	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-95	60-80	30-45	10-20

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
57C*, 58B*:											
Williams	0-6	Loam	CL, ML	A-4, A-6, A-7	0-5	95-100	95-100	85-95	60-90	25-45	3-20
	6-25	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	60-80	30-50	10-30
	25-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	60-80	30-50	10-30
Vida	0-4	Loam	CL-ML, CL	A-4	0-15	90-100	85-95	80-90	60-75	20-30	5-10
	4-20	Clay loam, loam	CL, CL-ML	A-4, A-6	0-15	90-100	90-100	85-95	50-80	25-40	5-20
	20-60	Clay loam, loam	CL, CL-ML	A-4, A-6	0-15	90-100	90-100	85-95	65-80	25-40	5-20
59D*:											
Vida	0-4	Loam	CL-ML, CL	A-4	0-15	90-100	85-95	80-90	60-75	20-30	5-10
	4-20	Clay loam, loam	CL, CL-ML	A-4, A-6	0-15	90-100	90-100	85-95	50-80	25-40	5-20
	20-60	Clay loam, loam	CL, CL-ML	A-4, A-6	0-15	90-100	90-100	85-95	65-80	25-40	5-20
Zahl	0-5	Loam	CL	A-6	0-5	95-100	95-100	80-95	55-75	25-40	10-20
	5-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	90-100	80-95	60-80	25-45	10-20
61E*:											
Zahl	0-5	Loam	CL	A-6	0-5	95-100	95-100	80-95	55-75	25-40	10-20
	5-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	90-100	80-95	60-80	25-45	10-20
Vida	0-4	Loam	CL-ML, CL	A-4	0-15	90-100	85-95	80-90	60-75	20-30	5-10
	4-20	Clay loam, loam	CL, CL-ML	A-4, A-6	0-15	90-100	90-100	85-95	50-80	25-40	5-20
	20-60	Clay loam, loam	CL, CL-ML	A-4, A-6	0-15	90-100	90-100	85-95	65-80	25-40	5-20
62	0-4	Very stony loam	CL-ML, CL	A-4	3-25	90-100	85-95	80-90	60-75	20-30	5-10
Vida	4-20	Clay loam, loam	CL, CL-ML	A-4, A-6	0-20	90-100	90-100	85-95	50-80	25-40	5-20
	20-60	Clay loam, loam	CL, CL-ML	A-4, A-6	0-20	90-100	90-100	85-95	65-80	25-40	5-20
65B*, 65C*:											
Bryant	0-8	Silt loam	ML, CL, CL-ML	A-6, A-4	0	100	100	85-100	70-100	20-40	5-22
	8-18	Clay loam, silt loam, silty clay loam.	CL, ML	A-6, A-4	0	100	100	85-100	70-100	25-40	7-20
	18-60	Clay loam, loam, silt loam.	CL, ML	A-6, A-4	0	100	100	85-100	70-100	25-40	7-20
Sutley	0-6	Silt loam	ML, CL-ML	A-4	0	100	100	90-100	70-100	25-35	5-10
	6-60	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	90-100	70-100	20-35	NP-8
65D*:											
Sutley	0-6	Silt loam	ML, CL-ML	A-4	0	100	100	90-100	70-100	25-35	5-10
	6-60	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	90-100	70-100	20-35	NP-8
Linton	0-60	Silt loam	ML	A-4	0	100	100	90-100	70-90	20-40	NP-10
66	0-10	Fine sandy loam	SM	A-2-4, A-4	0	100	90-100	55-85	30-50	<30	NP-7
Arveson	10-21	Fine sandy loam, sandy loam, loam.	SM, SM-SC	A-4	0	100	95-100	60-85	35-50	<20	NP-5
	21-60	Fine sand, loamy sand, sandy loam.	SP-SM, SM, SM-SC	A-3, A-2 A-4	0	100	95-100	50-80	5-45	<20	NP-5

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
67A, 67B---------- Farnuf	0-7	Loam----------	ML, CL	A-4	0	90-100	90-100	75-100	55-90	25-35	NP-10
	7-17	Clay loam, loam, silty clay loam.	CL	A-6	0	90-100	75-100	65-95	50-90	25-40	10-20
	17-60	Loam, clay loam	CL	A-6	0	90-100	75-100	65-95	65-80	25-40	10-20
68A*: Bryant----------	0-8	Silt loam-------	ML, CL, CL-ML	A-6, A-4	0	100	100	85-100	70-100	20-40	5-22
	8-18	Clay loam, silt loam, silty clay loam.	CL, ML	A-6, A-4	0	100	100	85-100	70-100	25-40	7-20
	18-60	Clay loam, loam, silt loam.	CL, ML	A-6, A-4	0	100	100	85-100	70-100	25-40	7-20
Grassna----------	0-26	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	70-90	25-45	5-20
	26-60	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	70-95	25-45	5-20
68B, 68C---------- Bryant	0-8	Silt loam-------	ML, CL, CL-ML	A-6, A-4	0	100	100	85-100	70-100	20-40	5-22
	8-18	Clay loam, silt loam, silty clay loam.	CL, ML	A-6, A-4	0	100	100	85-100	70-100	25-40	7-20
	18-60	Clay loam, loam, silt loam.	CL, ML	A-6, A-4	0	100	100	85-100	70-100	25-40	7-20
71*: Ranslo----------	0-8	Silt loam-------	CL, CL-ML, ML	A-4, A-6	0	100	100	90-100	70-90	25-40	5-15
	8-24	Silty clay, silty clay loam, clay loam.	CH, CL	A-7	0	100	100	95-100	75-90	40-60	15-30
	24-60	Clay loam, silty clay loam, sandy clay loam.	CL, CH	A-6, A-7	0	100	100	85-100	50-90	35-55	12-28
Harriet----------	0-2	Silt loam-------	CL, CL-ML	A-4, A-6, A-7	0	100	100	85-100	60-90	25-45	5-20
	2-60	Clay loam, silty clay loam, silty clay.	CL, CH	A-7, A-6	0	100	100	90-100	70-95	35-70	15-50
72---------- Straw	0-23	Loam----------	CL-ML, CL	A-4	0	100	100	85-100	60-90	20-30	5-10
	23-60	Loam, clay loam, sandy loam.	ML, CL	A-4, A-6	0	100	100	85-100	65-85	30-40	5-15
74A, 74B---------- Savage	0-3	Silt loam-------	CL	A-6	0	100	100	90-100	70-80	20-40	10-20
	3-15	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-70	20-45
	15-60	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-70	20-45

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
77*. Pits											
80---------- Ranslo	0-8	Silt loam-------	CL, CL-ML, ML	A-4, A-6	0	100	100	90-100	70-90	25-40	5-15
	8-24	Silty clay, silty clay loam, clay loam.	CH, CL	A-7	0	100	100	95-100	75-90	40-60	15-30
	24-60	Clay loam, silty clay loam, sandy clay loam.	CL, CH	A-6, A-7	0	100	100	85-100	50-90	35-55	12-28

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
1A----------	0-8	0.6-2.0	0.17-0.24	6.1-7.3	<2	Low-------	0.28	5	6
Bowbells	8-23	0.6-2.0	0.16-0.22	6.1-7.3	<2	Moderate	0.28		
	23-60	0.2-0.6	0.14-0.18	7.9-8.4	<2	Moderate	0.37		
2----------	0-6	0.2-0.6	0.18-0.23	6.6-7.3	<2	Moderate	0.32	5	7
Grail	6-38	0.2-0.6	0.14-0.17	6.6-8.4	<2	High------	0.32		
	38-60	0.2-0.6	0.13-0.22	7.4-8.4	<2	Moderate	0.32		
4----------	0-26	0.6-2.0	0.22-0.24	6.1-7.3	<2	Moderate	0.32	5	6
Grassna	26-60	0.6-2.0	0.16-0.22	6.6-8.4	<2	Moderate	0.32		
5*:									
Williams--------	0-6	0.6-2.0	0.17-0.24	6.6-7.3	<2	Low-------	0.28	5	6
	6-25	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.28		
	25-60	0.06-0.6	0.15-0.18	7.9-8.4	<2	Moderate	0.37		
Noonan----------	0-9	0.6-2.0	0.20-0.22	6.6-7.3	<2	Moderate	0.32	3	6
	9-19	0.06-0.2	0.12-0.14	7.4-9.0	<2	High------	0.32		
	19-60	0.06-0.2	0.10-0.14	7.9-9.0	2-8	Moderate	0.32		
7A, 7B----------	0-11	0.6-2.0	0.17-0.22	6.6-8.4	<2	Moderate	0.28	5	4L
Hamerly	11-23	0.6-2.0	0.15-0.19	7.4-8.4	<2	Moderate	0.28		
	23-60	0.2-2.0	0.14-0.19	7.4-8.4	<2	Moderate	0.37		
9C----------	0-3	6.0-20	0.10-0.12	6.1-7.3	<2	Low-------	0.15	5	2
Seroco	3-60	6.0-20	0.06-0.08	6.6-7.8	<2	Low-------	0.15		
9E*:									
Seroco----------	0-3	6.0-20	0.10-0.12	6.1-7.3	<2	Low-------	0.15	5	2
	3-60	6.0-20	0.06-0.08	6.6-7.8	<2	Low-------	0.15		
Dune land.									
10----------	0-2	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.43	1	6
Hurley	2-60	<0.06	0.05-0.13	7.4-9.0	4-16	High------	0.28		
11*:									
Hurley----------	0-2	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.43	1	6
	2-60	<0.06	0.05-0.13	7.4-9.0	4-16	High------	0.28		
Slickspots.									
13A, 13B, 13C----	0-7	2.0-6.0	0.10-0.16	6.6-7.8	<2	Low-------	0.20	5	3
Tally	7-42	2.0-6.0	0.10-0.16	6.6-8.4	<2	Low-------	0.20		
	42-60	2.0-6.0	0.06-0.10	7.4-8.4	<2	Low-------	0.17		
15----------	0-2	0.06-0.2	0.20-0.24	6.6-8.4	<2	Moderate	0.37	3	6
Harriet	2-60	0.06-0.2	0.15-0.23	8.5-9.0	4-16	High------	0.37		
16----------	0-24	0.06-0.2	0.10-0.15	7.4-9.0	>8	High------	0.28	5	8
Egas	24-60	0.06-0.2	0.08-0.13	7.9-9.0	>8	High------	0.28		
17----------	0-16	2.0-20	0.10-0.12	6.1-7.8	<2	Low-------	0.17	5	2
Hecla	16-23	2.0-20	0.10-0.12	6.1-7.8	<2	Low-------	0.17		
	23-60	2.0-20	0.06-0.13	6.1-7.8	<2	Low-------	0.17		
18----------	0-11	2.0-6.0	0.16-0.18	6.6-7.3	<2	Low-------	0.20	5	3
Parshall	11-60	2.0-6.0	0.12-0.17	6.6-8.4	<2	Low-------	0.20		
19----------	0-1	<0.06	0.15-0.24	5.6-7.3	<2	Moderate	0.28	3	7
Heil	1-60	<0.06	0.13-0.18	6.6-9.0	4-16	High------	0.28		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
20D----------	0-3	0.6-2.0	0.17-0.22	6.6-7.8	<2	Low-------	0.43	5	4L
Sully	3-60	0.6-2.0	0.15-0.20	7.4-8.4	<2	Low-------	0.43		
21A*:									
Linton----------	0-60	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low-------	0.32	5	5
Grassna---------	0-26	0.6-2.0	0.22-0.24	6.1-7.3	<2	Moderate	0.32	5	6
	26-60	0.6-2.0	0.16-0.22	6.6-8.4	<2	Moderate	0.32		
21B----------	0-60	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low-------	0.32	5	5
Linton									
21C*:									
Linton----------	0-60	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low-------	0.32	5	5
Sutley----------	0-6	0.6-2.0	0.19-0.22	6.6-8.4	<2	Low-------	0.32	5	4L
	6-60	0.6-2.0	0.15-0.20	7.4-8.4	<2	Low-------	0.43		
21D*:									
Sully-----------	0-3	0.6-2.0	0.17-0.22	6.6-7.8	<2	Low-------	0.43	5	4L
	3-60	0.6-2.0	0.15-0.20	7.4-8.4	<2	Low-------	0.43		
Zahl------------	0-5	0.6-2.0	0.17-0.22	6.6-7.8	<2	Moderate	0.28	5	4L
	5-60	0.06-2.0	0.15-0.19	7.4-8.4	<2	Moderate	0.37		
22B*:									
Linton----------	0-60	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low-------	0.32	5	5
Sutley----------	0-6	0.6-2.0	0.19-0.22	6.6-8.4	<2	Low-------	0.32	5	4L
	6-60	0.6-2.0	0.15-0.20	7.4-8.4	<2	Low-------	0.43		
22C----------	0-60	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low-------	0.32	5	5
Linton									
24A, 24C---------	0-8	6.0-20	0.10-0.12	6.6-7.8	<2	Low-------	0.17	5	2
Yecross	8-60	6.0-20	0.06-0.10	7.4-8.4	<2	Low-------	0.10		
27B, 27C---------	0-15	6.0-20	0.08-0.12	6.1-7.8	<2	Low-------	0.17	5	2
Maddock	15-60	6.0-20	0.05-0.13	6.1-8.4	<2	Low-------	0.17		
28----------	0-13	2.0-6.0	0.13-0.18	7.9-8.4	<2	Low-------	0.20	5	3
Wyndmere	13-40	2.0-6.0	0.12-0.17	7.9-8.4	<2	Low-------	0.20		
	40-60	2.0-6.0	0.06-0.16	7.9-8.4	<2	Low-------	0.20		
29----------	0-9	0.6-2.0	0.22-0.24	7.4-8.4	<2	Low-------	0.28	5	4L
Vallers	9-29	0.2-0.6	0.15-0.19	7.9-8.4	<2	Moderate	0.28		
	29-60	0.2-0.6	0.17-0.19	7.4-8.4	<2	Low-------	0.28		
30----------	0-16	0.2-0.6	0.18-0.22	6.1-7.8	<2	Moderate	0.28	5	8
Parnell	16-60	0.06-0.2	0.13-0.19	6.6-7.8	<2	High------	0.28		
31E----------	0-20	6.0-20	0.06-0.12	6.6-7.8	<2	Low-------	0.17	5	2
Lihen	20-32	6.0-20	0.06-0.12	6.6-7.8	<2	Low-------	0.17		
	32-60	6.0-20	0.08-0.16	7.4-8.4	<2	Low-------	0.17		
32F----------	0-5	6.0-20.0	0.08-0.12	6.6-8.4	<2	Low-------	0.17	2	2
Flasher	5-18	6.0-20.0	0.08-0.12	6.6-8.4	<2	Low-------	0.17		
	18-60	---	---	---	---	----------	----		
34A, 34B---------	0-6	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low-------	0.28	4	6
Bowdle	6-25	0.6-2.0	0.18-0.20	6.1-7.8	<2	Low-------	0.28		
	25-60	6.0-20.0	0.03-0.06	7.4-8.4	<2	Low-------	0.10		
36B*:									
Lehr----------	0-5	2.0-6.0	0.17-0.22	6.6-7.3	<2	Low-------	0.28	3	6
	5-17	2.0-6.0	0.17-0.20	6.6-7.8	<2	Moderate	0.28		
	17-60	6.0-20	0.02-0.04	7.4-8.4	<2	Low-------	0.10		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
36B*:									
Wabek	0-6	2.0-6.0	0.20-0.22	6.6-7.8	<2	Low	0.28	2	5
	6-10	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low	0.10		
	10-60	6.0-20	0.02-0.04	7.4-8.4	<2	Low	0.10		
38	0-16	0.2-0.6	0.18-0.22	6.1-7.8	<2	Moderate	0.28	5	7
Parnell	16-60	0.06-0.2	0.13-0.19	6.6-7.8	<2	High	0.28		
39E*:									
Sansarc	0-4	0.06-0.2	0.08-0.12	6.6-8.4	<2	High	0.37	2	4
	4-11	0.06-0.2	0.08-0.12	7.4-8.4	<2	High	0.37		
	11-60	---	---	5.6-8.4	---	---	---		
Opal	0-5	<0.06	0.10-0.14	6.6-7.8	<2	High	0.37	4	4
	5-25	<0.06	0.08-0.14	7.4-8.4	<2	High	0.37		
	25-31	<0.06	0.08-0.12	7.4-8.4	2-4	High	0.37		
	31-60	<0.06	---	6.6-8.4	<2	High	---		
40B, 40C	0-5	<0.06	0.10-0.14	6.6-7.8	<2	High	0.37	4	4
Opal	5-25	<0.06	0.08-0.14	7.4-8.4	<2	High	0.37		
	25-31	<0.06	0.08-0.12	7.4-8.4	2-4	High	0.37		
	31-60	<0.06	---	6.6-8.4	<2	High	---		
40D*:									
Opal	0-5	<0.06	0.10-0.14	6.6-7.8	<2	High	0.37	4	4
	5-25	<0.06	0.08-0.14	7.4-8.4	<2	High	0.37		
	25-31	<0.06	0.08-0.12	7.4-8.4	2-4	High	0.37		
	31-60	<0.06	---	6.6-8.4	<2	High	---		
Sansarc	0-4	0.06-0.2	0.08-0.12	6.6-8.4	<2	High	0.37	2	4
	4-11	0.06-0.2	0.08-0.12	7.4-8.4	<2	High	0.37		
	11-60	---	---	5.6-8.4	---	---	---		
41A, 41B	0-6	<0.2	0.10-0.14	6.1-7.8	<2	High	0.37	5	4
Promise	6-24	<0.2	0.08-0.14	7.4-9.0	<2	High	0.37		
	24-60	<0.2	0.10-0.12	7.4-9.0	2-4	High	0.37		
41C*:									
Promise	0-6	<0.2	0.10-0.14	6.1-7.8	<2	High	0.37	5	4
	6-24	<0.2	0.08-0.14	7.4-9.0	<2	High	0.37		
	24-60	<0.2	0.10-0.12	7.4-9.0	2-4	High	0.37		
Opal	0-5	<0.06	0.10-0.14	6.6-7.8	<2	High	0.37	4	4
	5-25	<0.06	0.08-0.14	7.4-8.4	<2	High	0.37		
	25-31	<0.06	0.08-0.12	7.4-8.4	2-4	High	0.37		
	31-60	<0.06	---	6.6-8.4	<2	High	---		
51	0-15	0.6-2.0	0.18-0.23	5.6-7.3	<2	Low	0.32	5	6
Tonka	15-60	0.06-0.2	0.14-0.19	5.6-7.8	<2	High	0.43		
52A, 52B	0-5	2.0-6.0	0.17-0.22	6.6-7.3	<2	Low	0.28	3	6
Lehr	5-17	2.0-6.0	0.17-0.20	6.6-7.8	<2	Moderate	0.28		
	17-60	6.0-20	0.02-0.04	7.4-8.4	<2	Low	0.10		
53D*:									
Wabek	0-6	2.0-6.0	0.20-0.22	6.6-7.8	<2	Low	0.28	2	6
	6-10	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low	0.10		
	10-60	6.0-20	0.02-0.04	7.4-8.4	<2	Low	0.10		
Lehr	0-5	2.0-6.0	0.17-0.22	6.6-7.3	<2	Low	0.28	3	6
	5-17	2.0-6.0	0.17-0.20	6.6-7.8	<2	Moderate	0.28		
	17-60	6.0-20	0.02-0.04	7.4-8.4	<2	Low	0.10		
53E	0-6	2.0-6.0	0.20-0.22	6.6-7.8	<2	Low	0.28	2	6
Wabek	6-10	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low	0.10		
	10-60	6.0-20	0.02-0.04	7.4-8.4	<2	Low	0.10		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
54----------	0-10	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low-------	0.28	4	4L
Divide	10-25	0.6-2.0	0.16-0.19	7.9-8.4	<2	Low-------	0.28		
	25-60	>6.0	0.03-0.07	7.9-8.4	<2	Low-------	0.10		
56----------	0-15	0.2-2.0	0.16-0.22	7.4-8.4	<4	Moderate	0.32	5	4L
Regan	15-60	0.2-2.0	0.14-0.17	7.4-9.0	<8	Moderate	0.32		
57A*, 57B*:									
Williams--------	0-6	0.6-2.0	0.17-0.24	6.6-7.3	<2	Low-------	0.28	5	6
	6-25	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.28		
	25-60	0.06-0.6	0.15-0.18	7.9-8.4	<2	Moderate	0.37		
Bowbells--------	0-8	0.6-2.0	0.17-0.24	6.1-7.3	<2	Low-------	0.28	5	6
	8-23	0.6-2.0	0.16-0.22	6.1-7.3	<2	Moderate	0.28		
	23-60	0.2-0.6	0.14-0.18	7.9-8.4	<2	Moderate	0.37		
57C*, 58B*:									
Williams--------	0-6	0.6-2.0	0.17-0.24	6.6-7.3	<2	Low-------	0.28	5	6
	6-25	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.28		
	25-60	0.06-0.6	0.15-0.18	7.9-8.4	<2	Moderate	0.37		
Vida----------	0-4	0.6-2.0	0.16-0.20	6.6-7.8	<2	Low-------	0.37	5	6
	4-20	0.6-2.0	0.12-0.20	6.6-8.4	<2	Moderate	0.37		
	20-60	0.06-0.6	0.12-0.20	7.9-9.0	<2	Moderate	0.37		
59D*:									
Vida----------	0-4	0.6-2.0	0.16-0.20	6.6-7.8	<2	Low-------	0.37	5	6
	4-20	0.6-2.0	0.12-0.20	6.6-8.4	<2	Moderate	0.37		
	20-60	0.06-0.6	0.12-0.20	7.9-9.0	<2	Moderate	0.37		
Zahl----------	0-5	0.6-2.0	0.17-0.22	6.6-7.8	<2	Moderate	0.28	5	4L
	5-60	0.06-2.0	0.15-0.19	7.4-8.4	<2	Moderate	0.37		
61E*:									
Zahl----------	0-5	0.6-2.0	0.17-0.22	6.6-7.8	<2	Moderate	0.28	5	4L
	5-60	0.06-2.0	0.15-0.19	7.4-8.4	<2	Moderate	0.37		
Vida----------	0-4	0.6-2.0	0.16-0.20	6.6-7.8	<2	Low-------	0.37	5	6
	4-20	0.6-2.0	0.12-0.20	6.6-8.4	<2	Moderate	0.37		
	20-60	0.06-0.6	0.12-0.20	7.9-9.0	<2	Moderate	0.37		
62----------	0-4	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low-------	0.37	5	8
Vida	4-20	0.6-2.0	0.12-0.20	6.6-9.0	<2	Moderate	0.37		
	20-60	0.06-0.6	0.12-0.20	7.9-9.0	<2	Moderate	0.37		
65B*, 65C*:									
Bryant----------	0-8	0.6-2.0	0.18-0.20	6.1-7.3	<2	Moderate	0.32	5	6
	8-18	0.6-2.0	0.19-0.22	6.6-7.8	<2	Moderate	0.43		
	18-60	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.43		
Sutley----------	0-6	0.6-2.0	0.19-0.22	6.6-8.4	<2	Low-------	0.32	5	4L
	6-60	0.6-2.0	0.15-0.20	7.4-8.4	<2	Low-------	0.43		
65D*:									
Sutley----------	0-6	0.6-2.0	0.19-0.22	6.6-8.4	<2	Low-------	0.32	5	4L
	6-60	0.6-2.0	0.15-0.20	7.4-8.4	<2	Low-------	0.43		
Linton----------	0-60	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low-------	0.32	5	5
66----------	0-10	2.0-6.0	0.13-0.15	7.4-8.4	<2	Low-------	0.24	2	3
Arveson	10-21	0.6-6.0	0.15-0.17	7.9-8.4	<2	Low-------	0.24		
	21-60	2.0-20	0.05-0.15	7.4-8.4	<2	Low-------	0.24		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
67A, 67B--------- Farnuf	0-7 7-17 17-60	0.6-2.0 0.6-2.0 0.6-2.0	0.15-0.20 0.14-0.20 0.14-0.20	6.1-7.8 6.1-7.8 7.4-8.4	<2 <2 <2	Low------- Moderate Moderate	0.32 0.32 0.32	5	6
68A*: Bryant---------- 	0-8 8-18 18-60	0.6-2.0 0.6-2.0 0.6-2.0	0.18-0.20 0.19-0.22 0.17-0.20	6.1-7.3 6.6-7.8 7.4-8.4	<2 <2 <2	Moderate Moderate Moderate	0.32 0.43 0.43	5	6
Grassna--------- 	0-26 26-60	0.6-2.0 0.6-2.0	0.22-0.24 0.16-0.22	6.1-7.3 6.6-8.4	<2 <2	Moderate Moderate	0.32 0.32	5	6
68B, 68C--------- Bryant	0-8 8-18 18-60	0.6-2.0 0.6-2.0 0.6-2.0	0.18-0.20 0.19-0.22 0.17-0.20	6.1-7.3 6.6-7.8 7.4-8.4	<2 <2 <2	Moderate Moderate Moderate	0.32 0.43 0.43	5	6
71*: Ranslo---------- 	0-8 8-24 24-60	0.6-2.0 0.06-0.2 0.2-0.6	0.19-0.22 0.13-0.16 0.14-0.17	5.6-7.3 6.6-8.4 7.4-9.0	<2 2-4 2-8	Low------- High------ High------	0.37 0.28 0.28	5	6
Harriet--------- 	0-2 2-60	0.06-0.2 0.06-0.2	0.20-0.24 0.15-0.23	6.6-8.4 8.5-9.0	<2 4-16	Moderate High------	0.37 0.37	3	6
72--------------- Straw	0-23 23-60	0.6-2.0 0.6-2.0	0.16-0.18 0.16-0.19	6.6-8.4 7.4-8.4	<2 <2	Low------- Moderate	0.32 0.32	5	5
74A, 74B--------- Savage	0-3 3-15 15-60	0.6-2.0 0.2-0.6 0.2-0.6	0.22-0.24 0.12-0.20 0.12-0.20	6.6-7.8 6.6-7.8 7.4-8.4	<2 <2 2-4	Moderate High------ High------	0.37 0.37 0.37	5	6
77*. Pits									
80--------------- Ranslo	0-8 8-24 24-60	0.6-2.0 0.06-0.2 0.2-0.6	0.19-0.22 0.13-0.16 0.14-0.17	5.6-7.3 6.6-8.4 7.4-9.0	<2 2-4 2-8	Low------- High------ High------	0.37 0.28 0.28	5	6

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the Glossary explain terms such as "rare," "brief," "apparent," and "perched." The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
1A---------- Bowbells	B	Frequent----	Very brief	Mar-Nov	4.0-6.0	Perched	Apr-Jun	>60	---	High-----	High-----	Low.
2---------- Grail	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
4---------- Grassna	B	Frequent----	Very brief	Mar-Nov	4.0-6.0	Perched	Apr-Jun	>60	---	Moderate	High-----	Low.
5*:												
Williams----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Noonan----------	D	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
7A, 7B---------- Hamerly	C	None--------	---	---	1.5-3.0	Apparent	Sep-Jun	>60	---	High-----	High-----	Low.
9C---------- Seroco	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
9E*:												
Seroco----------	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
Dune land.												
10---------- Hurley	D	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
11*:												
Hurley----------	D	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
Slickspots.												
13A, 13B, 13C----- Tally	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
15---------- Harriet	D	Occasional	Long------	Apr-Jun	0-1.0	Apparent	Sep-Jun	>60	---	High-----	High-----	Moderate.
16---------- Egas	D	Frequent----	Brief-----	Apr-Oct	0-1.0	Apparent	Oct-Jun	>60	---	High-----	High-----	Moderate.
17---------- Hecla	A	None--------	---	---	3.0-6.0	Apparent	Apr-Oct	>60	---	Moderate	Moderate	Low.
18---------- Parshall	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
19**---------- Heil	D	Frequent----	Long------	Apr-Jun	+.5-1.0	Apparent	Sep-Jun	>60	---	Moderate	High-----	Moderate.

See footnotes at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
20D---------- Sully	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
21A*:												
Linton----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Grassna----------	B	Frequent----	Very brief	Mar-Nov	4.0-6.0	Perched	Apr-Jun	>60	---	Moderate	High-----	Low.
21B---------- Linton	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
21C*:												
Linton----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Sutley----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
21D*:												
Sully----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Zahl----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
22B*:												
Linton----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Sutley----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
22C---------- Linton	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
24A, 24C---------- Yecross	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
27B, 27C---------- Maddock	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
28---------- Wyndmere	B	None--------	---	---	2.0-5.0	Apparent	Sep-Jun	>60	---	High-----	High-----	Low.
29---------- Vallers	C	Rare--------	---	---	1.0-2.5	Apparent	Nov-Jun	>60	---	High-----	High-----	Low.
30**---------- Parnell	C/D	Frequent----	Very long	Jan-Dec	+2-1.0	Apparent	Jan-Dec	>60	---	High-----	High-----	Low.
31E---------- Lihen	A	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
32F---------- Flasher	D	None--------	---	---	>6.0	---	---	7-20	Rippable	Low------	Moderate	Low.
34A, 34B---------- Bowdle	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.

See footnotes at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
36B*:												
Lehr	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Wabek	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
38** Parnell	C/D	Frequent	Long	Apr-Nov	+1-2.0	Perched	Jan-Dec	>60	---	High	High	Low.
39E*:												
Sansarc	D	None	---	---	>6.0	---	---	4-20	Rippable	Low	High	Moderate.
Opal	D	None	---	---	>6.0	---	---	20-40	Rippable	Low	High	Moderate.
40B, 40C Opal	D	None	---	---	>6.0	---	---	20-40	Rippable	Low	High	Moderate.
40D*:												
Opal	D	None	---	---	>6.0	---	---	20-40	Rippable	Low	High	Moderate.
Sansarc	D	None	---	---	>6.0	---	---	4-20	Rippable	Low	High	Moderate.
41A, 41B Promise	D	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
41C*:												
Promise	D	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Opal	D	None	---	---	>6.0	---	---	20-40	Rippable	Low	High	Moderate.
51** Tonka	C/D	Frequent	Long	Apr-Jun	+1-1.0	Perched	Sep-Jun	>60	---	High	High	Low.
52A, 52B Lehr	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
53D*:												
Wabek	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Lehr	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
53E Wabek	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
54 Divide	B	None	---	---	2.5-5.0	Apparent	Sep-Jun	>60	---	Moderate	High	Low.
56 Regan	B/D	Frequent	Brief to long.	Mar-Jun	0-1.0	Apparent	Oct-Jun	>60	---	High	High	Low.
57A*, 57B*:												
Williams	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Bowbells	B	Frequent	Very brief	Mar-Nov	4.0-6.0	Perched	Apr-Jun	>60	---	High	High	Low.

See footnotes at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
57C*, 58B*:												
Williams	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Vida	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
59D*:												
Vida	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Zahl	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
61E*:												
Zahl	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Vida	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
62--Vida	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
65B*, 65C*:												
Bryant	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Sutley	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
65D*:												
Sutley	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Linton	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
66--Arveson	A/D	Frequent	Brief	Apr-Jun	0-1.0	Apparent	Apr-Jul	>60	---	High	High	Low.
67A, 67B--Farnuf	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
68A*:												
Bryant	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Grassna	B	Frequent	Very brief	Mar-Nov	4.0-6.0	Perched	Apr-Jun	>60	---	Moderate	High	Low.
68B, 68C--Bryant	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
71*:												
Ranslo	D	Occasional	Very brief	May-Oct	3.0-5.0	Apparent	Oct-Jun	>60	---	High	High	Moderate.
Harriet	D	Occasional	Long	Apr-Jun	0-1.0	Apparent	Sep-Jun	>60	---	High	High	Moderate.
72--Straw	B	Occasional	Brief	Mar-May	4.0-6.0	Perched	Mar-Jun	>60	---	Moderate	High	Moderate.

See footnotes at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
74A, 74B---------- Savage	C	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
77*. Pits												
80---------- Ranslo	D	Occasional	Very brief	May-Oct	3.0-5.0	Apparent	Oct-Jun	>60	---	High-----	High-----	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

** A plus sign preceding the range in depth to the water table indicates that the water table can be as high as the specified number of feet above the surface.

TABLE 17.--ENGINEERING TEST DATA

[Dashes indicate data were not available. NP means nonplastic]

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution								Liquid limit	Plasticity index	Moisture density	
			Percentage passing sieve--					Percentage smaller than--						
	AASHTO	Unified	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			Max. dry density	Optimum moisture
											Pct		Lb/ ft3	Pct
Farnuf loam:[1] (S75SD-021-001)														
Ap------- 0 to 7	A-4(04)	CL	100	100	100	86	66	--	19	--	28	9	108	18
B21t----- 7 to 11	A-6(06)	CL	100	100	100	81	56	--	25	--	34	17	115	15
C1ca-----25 to 47	A-6(13)	CL	100	100	100	91	77	--	33	--	38	18	108	18
Lehr loam:[2] (S75SD-021-002)														
B2------- 5 to 14	A-4(01)	SC	100	96	92	75	41	--	--	--	27	10	112	16
IIC------17 to 35	A-2-4(00)	SM-SC	100	94	90	66	22	--	--	--	26	7	112	16
Seroco loamy fine sand:[3] (S75SD-021-003)														
C1-------10 to 40	A-2-4(00)	SM	100	100	100	86	--	--	--	--	19	NP	104	12
Tally fine sandy loam:[4] (S75SD-021-004)														
Ap------- 0 to 7	A-4(00)	SM-SC	100	100	100	97	43	--	19	--	24	7	115	15
B2------- 7 to 15	A-2-4(00)	SM	100	100	100	96	23	--	15	--	22	3	116	14
C1ca-----15 to 42	A-2-4(00)	SM-SC	100	100	100	97	32	--	19	--	24	5	116	14
Vida loam:[5] (S75SD-021-005)														
B2t------ 4 to 8	A-6(05)	CL	100	99	97	86	53	--	24	--	36	15	102	20
C1ca-----20 to 32	A-6(10)	CL	100	96	94	87	68	--	31	--	35	18	111	17
Zahl loam:[6] (S75SD-021-006)														
C1ca----- 5 to 24	A-7-6(13)	CL	100	98	96	89	70	--	37	--	42	20	101	21
C2-------24 to 42	A-6(09)	CL	100	96	93	84	62	--	30	--	37	18	107	18

[1]Farnuf loam:
250 feet west and 25 feet north of the southeast corner of sec. 17, T. 128 N., R. 78 W.

[2]Lehr loam:
390 feet north and 115 feet east of the southwest corner of sec. 28, T. 125 N., R. 75 W.

[3]Seroco loamy fine sand:
2,240 feet west and 130 feet south of the northeast corner of sec. 27, T. 125 N., R. 76 W.

[4]Tally fine sandy loam:
1,255 feet south and 90 feet west of the northeast corner of sec. 22, T. 125 N., R. 76 W.

[5]Vida loam:
1,690 feet north and 65 feet east of the southwest corner of sec. 31, T. 126 N., R. 74 W.

[6]Zahl loam:
1,585 feet east and 100 feet south of the northwest corner of sec. 32, T. 126 N., R. 74 W.

TABLE 18.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Arveson	Coarse-loamy, frigid Typic Calciaquolls
Bowbells	Fine-loamy, mixed Pachic Argiborolls
*Bowdle	Fine-loamy over sandy or sandy-skeletal, mixed Pachic Haploborolls
Bryant	Fine-silty, mixed Typic Haploborolls
Divide	Fine-loamy over sandy or sandy-skeletal, frigid Aeric Calciaquolls
*Egas	Fine, montmorillonitic (calcareous), mesic Typic Haplaquolls
Farnuf	Fine-loamy, mixed Typic Argiborolls
Flasher	Mixed, frigid, shallow Typic Ustipsamments
*Grail	Fine, montmorillonitic Pachic Argiborolls
*Grassna	Fine-silty, mixed Pachic Haploborolls
Hamerly	Fine-loamy, frigid Aeric Calciaquolls
Harriet	Fine, mixed, frigid Typic Natraquolls
Hecla	Sandy, mixed Aquic Haploborolls
Heil	Fine, montmorillonitic, frigid Typic Natraquolls
Hurley	Very fine, montmorillonitic, mesic Leptic Natrustolls
Lehr	Fine-loamy over sandy or sandy-skeletal, mixed Typic Haploborolls
Lihen	Sandy, mixed Entic Haploborolls
Linton	Coarse-silty, mixed Typic Haploborolls
Maddock	Sandy, mixed Udorthentic Haploborolls
*Noonan	Fine-loamy, mixed Typic Natriborolls
Opal	Very fine, montmorillonitic, mesic Vertic Haplustolls
Parnell	Fine, montmorillonitic, frigid Typic Argiaquolls
Parshall	Coarse-loamy, mixed Pachic Haploborolls
*Promise	Very fine, montmorillonitic, mesic Vertic Haplustolls
Ranslo	Fine, montmorillonitic, frigid Typic Natraquolls
Regan	Fine-silty, frigid Typic Calciaquolls
Sansarc	Clayey, montmorillonitic (calcareous), mesic, shallow Typic Ustorthents
Savage	Fine, montmorillonitic Typic Argiborolls
Seroco	Mixed, frigid Typic Ustipsamments
*Straw	Fine-loamy, mixed Cumulic Haploborolls
Sully	Coarse-silty, mixed (calcareous), mesic Typic Ustorthents
Sutley	Coarse-silty, mixed Entic Haploborolls
Tally	Coarse-loamy, mixed Typic Haploborolls
Tonka	Fine, montmorillonitic, frigid Argiaquic Argialbolls
Vallers	Fine-loamy, frigid Typic Calciaquolls
Vida	Fine-loamy, mixed Typic Argiborolls
Wabek	Sandy-skeletal, mixed Entic Haploborolls
Williams	Fine-loamy, mixed Typic Argiborolls
Wyndmere	Coarse-loamy, frigid Aeric Calciaquolls
Yecross	Mixed, frigid Typic Ustipsamments
Zahl	Fine-loamy, mixed Entic Haploborolls

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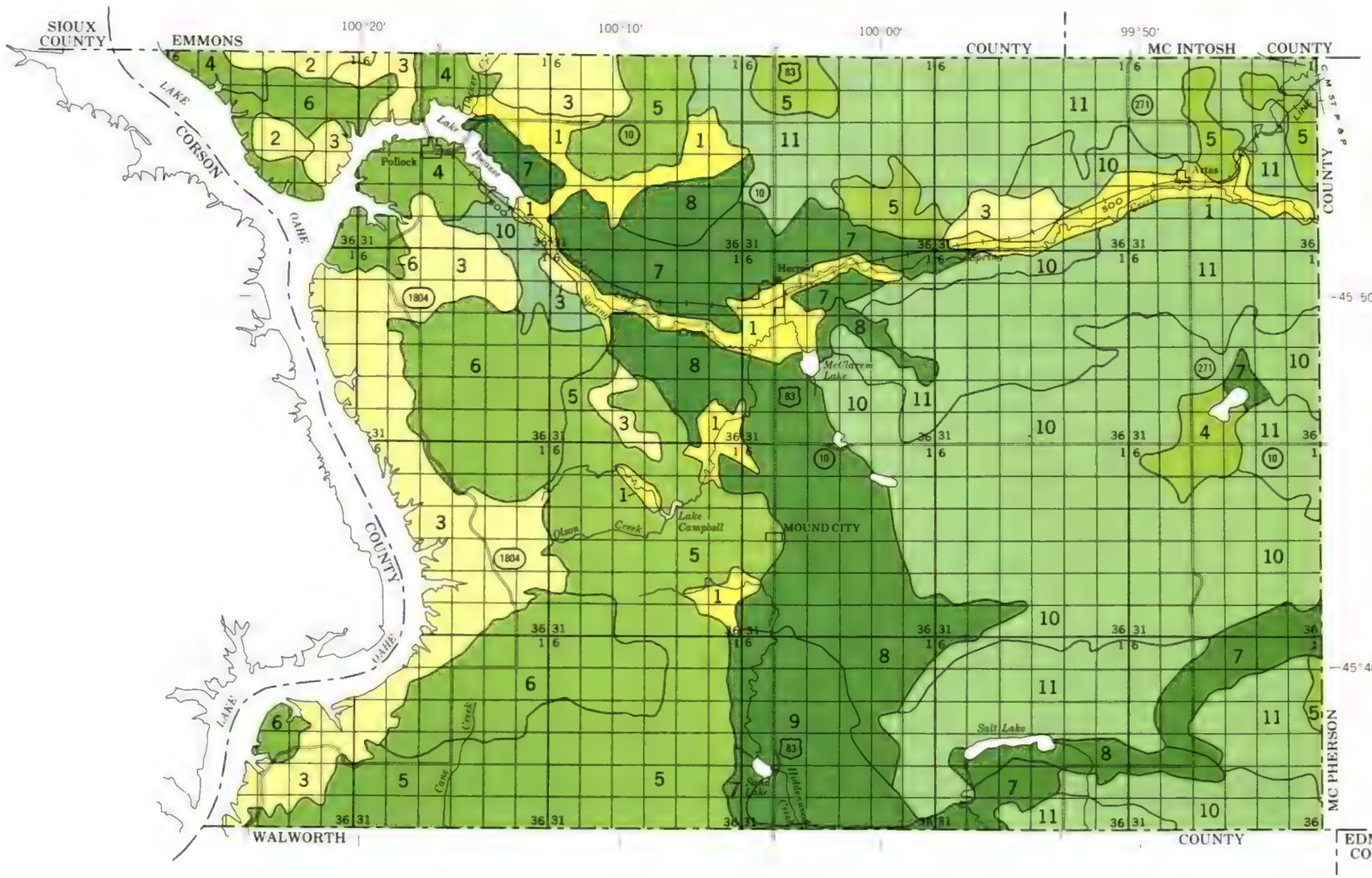
NORTH DAKOTA



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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

CAMPBELL COUNTY, SOUTH DAKOTA

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 1 2 3 4 5 6 Kilometers

SOIL LEGEND*

NEARLY LEVEL, SODIUM AFFECTED SOILS ON FLOOD PLAINS

1 — Harriet–Ranslo association: Deep, poorly drained and somewhat poorly drained, nearly level silty soils on flood plains

NEARLY LEVEL TO VERY STEEP CLAYEY AND SANDY SOILS UNDERLAIN BY BEDROCK

2 — Lihen–Flasher association: Deep and shallow, well drained and somewhat excessively drained, strongly sloping to very steep sandy soils on uplands

3 — Opal–Sansarc–Promise association: Shallow to deep, well drained, nearly level to steep clayey soils on uplands

NEARLY LEVEL TO STRONGLY SLOPING LOAMY AND SILTY SOILS ON UPLANDS AND TERRACES AND IN UPLAND SWALES

4 — Farnuf–Grail association: Deep, well drained, nearly level and gently sloping loamy and silty soils on terraces

5 — Bryant–Grassna association: Deep, well drained and moderately well drained, nearly level to moderately sloping silty soils on uplands and in upland swales

6 — Linton–Grassna association: Deep, well drained and moderately well drained, nearly level to strongly sloping silty soils on terraces and uplands and in upland swales

NEARLY LEVEL TO STRONGLY SLOPING LOAMY AND SANDY SOILS ON TERRACES AND UPLANDS

7 — Lehr–Bowdle association: Deep, somewhat excessively drained and well drained, nearly level to strongly sloping loamy soils on terraces

8 — Tally–Maddock association: Deep, well drained, nearly level to strongly sloping loamy and sandy soils on uplands

9 — Yecross–Maddock association: Deep, excessively drained and well drained, nearly level to strongly sloping sandy soils on uplands

NEARLY LEVEL TO MODERATELY STEEP LOAMY SOILS ON UPLANDS AND IN UPLAND SWALES

10 — Vida–Williams association: Deep, well drained, nearly level to moderately steep loamy soils on uplands

11 — Williams–Bowbells association: Deep, well drained and moderately well drained, nearly level to moderately sloping loamy soils on uplands and in upland swales

* Texture terms in the descriptive headings refer to the texture of the surface layer of the major soils in each association.

Compiled 1979

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

INDEX TO MAP SHEETS

CAMPBELL COUNTY, SOUTH DAKOTA

N

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SOIL LEGEND

Each symbol consists of one or more numbers or a combination of numbers and letters, for example, 66, 1A, or 52B. If slope is given in the soil name, the third letter designation A, B, C, D, E, or F usually indicates the class of slope. Symbols without a slope letter are for soils that are level or nearly level or for miscellaneous areas.

SYMBOL	NAME	SYMBOL	NAME
1A	Bowbells loam	38	Parnell silty clay loam
2	Grail silty clay loam	39E	Sansarc–Opal clays, 15 to 40 percent slopes
4	Grassna silt loam	40B	Opal clay, 3 to 6 percent slopes
5	Williams–Noonan loams, 0 to 4 percent slopes	40C	Opal clay, 6 to 9 percent slopes
7A	Hamerly silt loam, 0 to 3 percent slopes	40D	Opal–Sansarc clays, 6 to 15 percent slopes
7B	Hamerly silt loam, 3 to 6 percent slopes	41A	Promise clay, 0 to 3 percent slopes
9C	Seroco loamy fine sand, 2 to 15 percent slopes	41B	Promise clay, 3 to 6 percent slopes
9E	Seroco–Dune land complex	41C	Promise–Opal clays, 6 to 9 percent slopes
10	Hurley silt loam, 0 to 6 percent slopes	51	Tonka silt loam
11	Hurley–Slickspots complex, 0 to 6 percent slopes	52A	Lehr loam, 0 to 3 percent slopes
13A	Tally fine sandy loam, 0 to 3 percent slopes	52B	Lehr loam, 3 to 6 percent slopes
13B	Tally fine sandy loam, 3 to 6 percent slopes	53D	Wabek–Lehr loams, 6 to 15 percent slopes
13C	Tally fine sandy loam, 6 to 9 percent slopes	53E	Wabek loam, 9 to 25 percent slopes
15	Harriet silt loam	54	Divide loam, 0 to 4 percent slopes
16	Egas silty clay loam	56	Regan silt loam
17	Hecla loamy sand	57A	Williams–Bowbells loams, 0 to 3 percent slopes
18	Parshall fine sandy loam	57B	Williams–Bowbells loams, 3 to 6 percent slopes
19	Heil silt loam	57C	Williams–Vida loams, 6 to 9 percent slopes
20D	Sully silt loam, 9 to 25 percent slopes	58B	Williams–Vida loams, 3 to 6 percent slopes
21A	Linton–Grassna silt loams, 0 to 3 percent slopes	59D	Vida–Zahl loams, 6 to 15 percent slopes
21B	Linton silt loam, 3 to 6 percent slopes	61E	Zahl–Vida loams, 9 to 30 percent slopes
21C	Linton–Sutley silt loams, 6 to 9 percent slopes	62	Vida very stony loam, 3 to 15 percent slopes
21D	Sully–Zahl complex, 9 to 40 percent slopes	65B	Bryant–Sutley silt loams, 2 to 6 percent slopes
22B	Linton–Sutley silt loams, 2 to 6 percent slopes	65C	Bryant–Sutley silt loams, 6 to 9 percent slopes
22C	Linton silt loam, 6 to 9 percent slopes	65D	Sutley–Linton silt loams, 9 to 15 percent slopes
24A	Yecross loamy sand, 0 to 6 percent slopes	66	Arveson fine sandy loam
24C	Yecross loamy sand, 6 to 15 percent slopes	67A	Farnuf loam, 0 to 3 percent slopes
27B	Maddock loamy fine sand, 0 to 6 percent slopes	67B	Farnuf loam, 3 to 6 percent slopes
27C	Maddock loamy fine sand, 6 to 12 percent slopes	68A	Bryant–Grassna silt loams, 0 to 3 percent slopes
28	Wyndmere fine sandy loam, 0 to 3 percent slopes	68B	Bryant silt loam, 3 to 6 percent slopes
29	Vallers loam	68C	Bryant silt loam, 6 to 9 percent slopes
30	Parnell silty clay loam, ponded	71	Ranslo–Harriet silt loams
31E	Lihen loamy fine sand, 9 to 20 percent slopes	72	Straw loam, channeled
32F	Flasher loamy fine sand, 25 to 50 percent slopes	74A	Savage silt loam, 0 to 3 percent slopes
34A	Bowdle loam, 0 to 3 percent slopes	74B	Savage silt loam, 3 to 6 percent slopes
34B	Bowdle loam, 3 to 6 percent slopes	77	Pits, gravel
36B	Lehr–Wabek loams, 2 to 6 percent slopes	80	Ranslo silt loam

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (79)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water)

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (saline)
- Intermittent (int)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (66, 57A)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) (S)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot (0)

CAMPBELL COUNTY, SOUTH DAKOTA — SHEET NUMBER 1

EMMONS COUNTY R. 79 W. NORTH DAKOTA

1 885 000 FEET

765 000 FEET

T 128 N

(Joins inset, 1)

LAKE OAHE

EMMONS COUNTY ND

1 881 000 FEET R. 80 W.

T. 128 N

(Joins sheet 1)

1000-FOOT GRID TICKS

INDEFINITE BOUNDARY

CORSON COUNTY

(Joins sheet 2)

(Joins inset, 50)

1

N

1 Mile

5 000 Feet

Scale 1:20000

This map was compiled on 1974 aerial photography by the U. S. Department of Agriculture Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners if shown are approximately positioned

CAMPBELL COUNTY, SOUTH DAKOTA — SHEET NUMBER 2

R 79 W. R 78 W.

EMMONS COUNTY NORTH DAKOTA

T. 128 N.

(Joins sheet 1)

(Joins sheet 3)

LAKE POCASSE

LAKE OAHE

SPRING VALLEY CEMETERY

Pollock

Scale 1:20000

1 Mile

5,000 Feet

CAMPBELL COUNTY, SOUTH DAKOTA — SHEET NUMBER 3

3

N

EMMONS COUNTY NORTH DAKOTA

R 78 W R 77 W

1 930 000 FEET

764 000 FEET

T 128 N.

(Joins sheet 2)

(Joins sheet 4)

(Joins sheet 10)

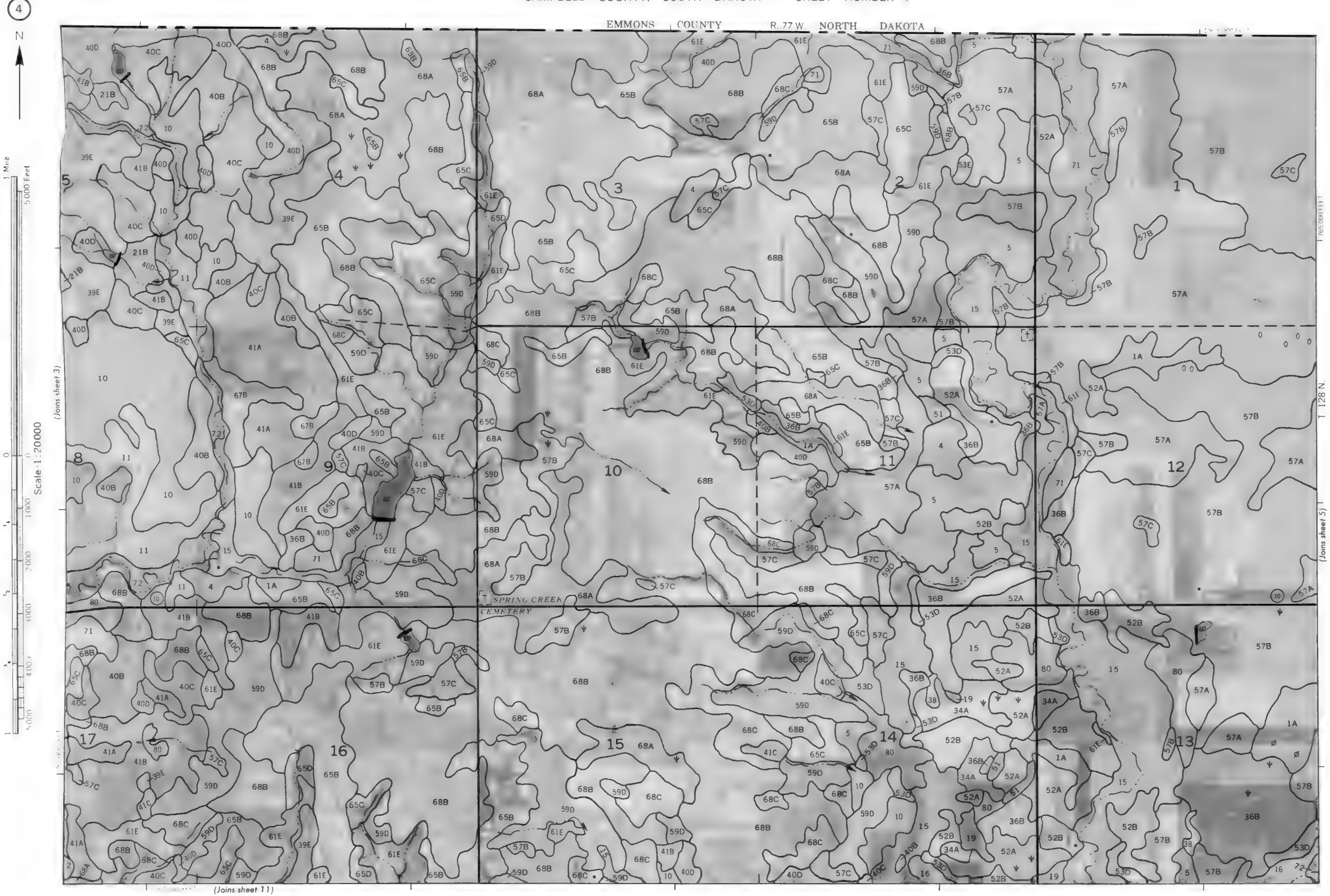
1 450 000 FEET

LAKE POCASSE

1 Mile

5000 Feet

Scale 1:20000


4
N
EMMONS COUNTY
R. 77 W.
NORTH DAKOTA
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 11)
T. 128 N.
SPRING CREEK CEMETERY
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000

CAMPBELL COUNTY SOUTH DAKOTA — SHEET NUMBER 5

EMMONS COUNTY R. 76 W. NORTH DAKOTA

1,980,000 FEET

765,000 FEET

T. 128 N.

(Joins sheet 4)

(Joins sheet 6)

(Joins sheet 12)

2,000,000 FEET

5

N

1 Mile

5,000 Feet

Scale 1:20000

CAMPBELL COUNTY, SOUTH DAKOTA — SHEET NUMBER 6

6

N

R. 76 W. | R. 75 W.

EMMONS COUNTY NORTH DAKOTA

2 020 000 FEET

T. 128 N.

(Joins sheet 5)

(Joins sheet 7)

(Joins sheet 13)

THULL CEMETERY

FREIDEN CEMETERY

1 Mile 5 000 Feet

Scale · 1:20000

0 1 000 2 000 3 000 4 000 5 000

CAMPBELL COUNTY, SOUTH DAKOTA — SHEET NUMBER 7

EMMONS COUNTY NORTH DAKOTA | McINTOSH COUNTY NORTH DAKOTA

2 025 000 FEET

R. 75 W. | R. 74 W.

T. 128 N

2 045 000 FEET

(Joins sheet 6)

(Joins sheet 8)

(Joins sheet 14)

7

N

1 Mile

5000 Feet

Scale 1:20000

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Coordinate grid ticks and land division corners if shown are approximately positioned

(8)

N

McINTOSH COUNTY, NORTH DAKOTA

R 74 W

2 070 000 FEET

CHICAGO, MILWAUKEE, ST PAUL AND PACIFIC

LINE

T. 128 N

MC PHERSON COUNTY

GREENWAY CEMETERY

(Joins sheet 7)

(Joins sheet 15)

1 Mile

5000 Feet

Scale 1:20000

0 1/4 1/2 3/4 1

0 1000 2000 3000 4000 5000

CAMPBELL COUNTY, SOUTH DAKOTA — SHEET NUMBER 9

9

N

R 79 W. | R. 78 W

(Joins sheet 2)

Pollock

SOO LINE

T 128 N

(Joins inset, sheet 50)

(Joins sheet 10)

(Joins sheet 16)

LAKE OAHE

1 Mile

5000 Feet

Scale 1:20000

CAMPBELL COUNTY, SOUTH DAKOTA — SHEET NUMBER 10

10

N

R 78 W | R 77 W.

(Joins sheet 3)

Sewage Disposal Area

LAKE POCASSE

SPRING CREEK

LINE

(Joins sheet 9)

(Joins sheet 11)

(Joins sheet 17)

T. 128 N

1 Mile 5,000 Feet

Scale 1:20000

CAMPBELL COUNTY, SOUTH DAKOTA — SHEET NUMBER 11

11

N

R 77 W.

T 128 N

(Joins sheet 4)

(Joins sheet 12)

(Joins sheet 10)

(Joins sheet 18)

1 Mile

5000 Feet

Scale 1:20000

This map is compiled on 1974 aerial photographs by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners are approximately positioned

12

N

(Joins sheet 5)

R 76 W

T 128 N

(Joins sheet 11)

(Joins sheet 13)

(Joins sheet 19)

1 Mile

5,000 Feet

Scale 1:20000

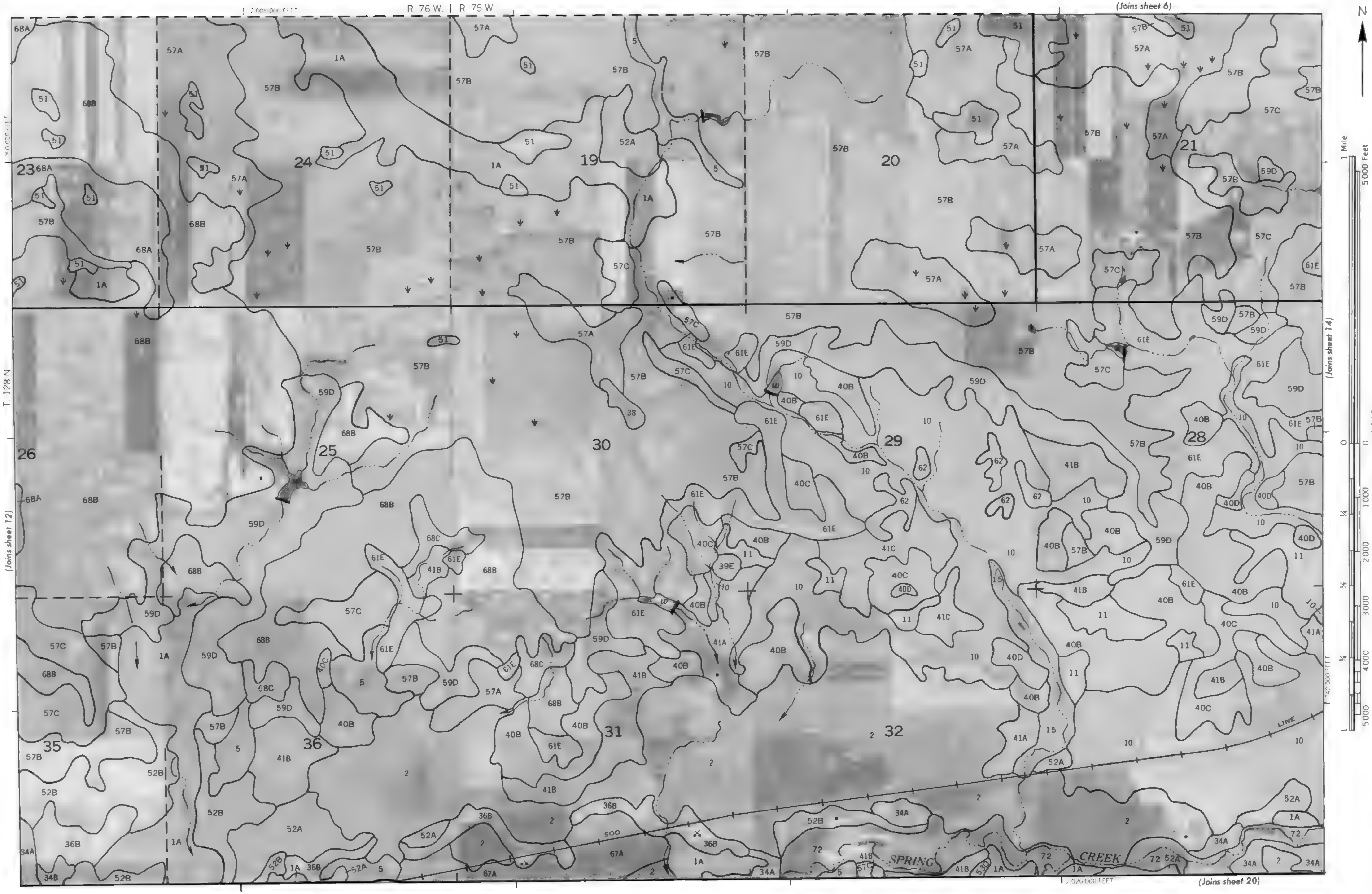
0 1/4 1/2 3/4 1

0 1000 2000 3000 4000 5000

19 20 21 22 23

30 29 28 27 26

31 32 33 34 35


R 76 W.
R 75 W
(Joins sheet 6)
(Joins sheet 14)
(Joins sheet 12)
(Joins sheet 20)
T. 128 N
N
1 Mile
5000 Feet
Scale 1:20 000
SPRING
CREEK
LINE
23
24
19
20
21
26
25
30
29
28
35
36
31
32

(14)

N

1 Mile

5000 Feet

Scale 1:20000

(Joins sheet 7)

(Joins sheet 13)

(Joins sheet 21)

(Joins sheet 15)

R. 75 W.

R. 74 W.

T. 128 N.

22 23 24 19 20

27 26 25 30 29

34 35 36 31 32

SPRING CREEK

LINE

500

CAMPBELL COUNTY, SOUTH DAKOTA — SHEET NUMBER 15

15

N

(Joins sheet 8)

R. 74 W.

T. 128 N.

(Joins sheet 14)

(Joins sheet 22)

Artas

Sewage Disposal Area

SPRING CREEK

ARTAS CEMETERY

McPHERSON COUNTY

1 Mile

5000 Feet

Scale 1:20000

This map is compiled on 9-4 aerial photography by the U. S. Department of Agriculture Soil Conservation Service and cooperating agencies. Control grid blocks and land division corrections shown are approximate.

16

N

R 79 W. R 78 W.

(Joins sheet 9)

LAKE OAHE

T 127 N

(Joins sheet 17)

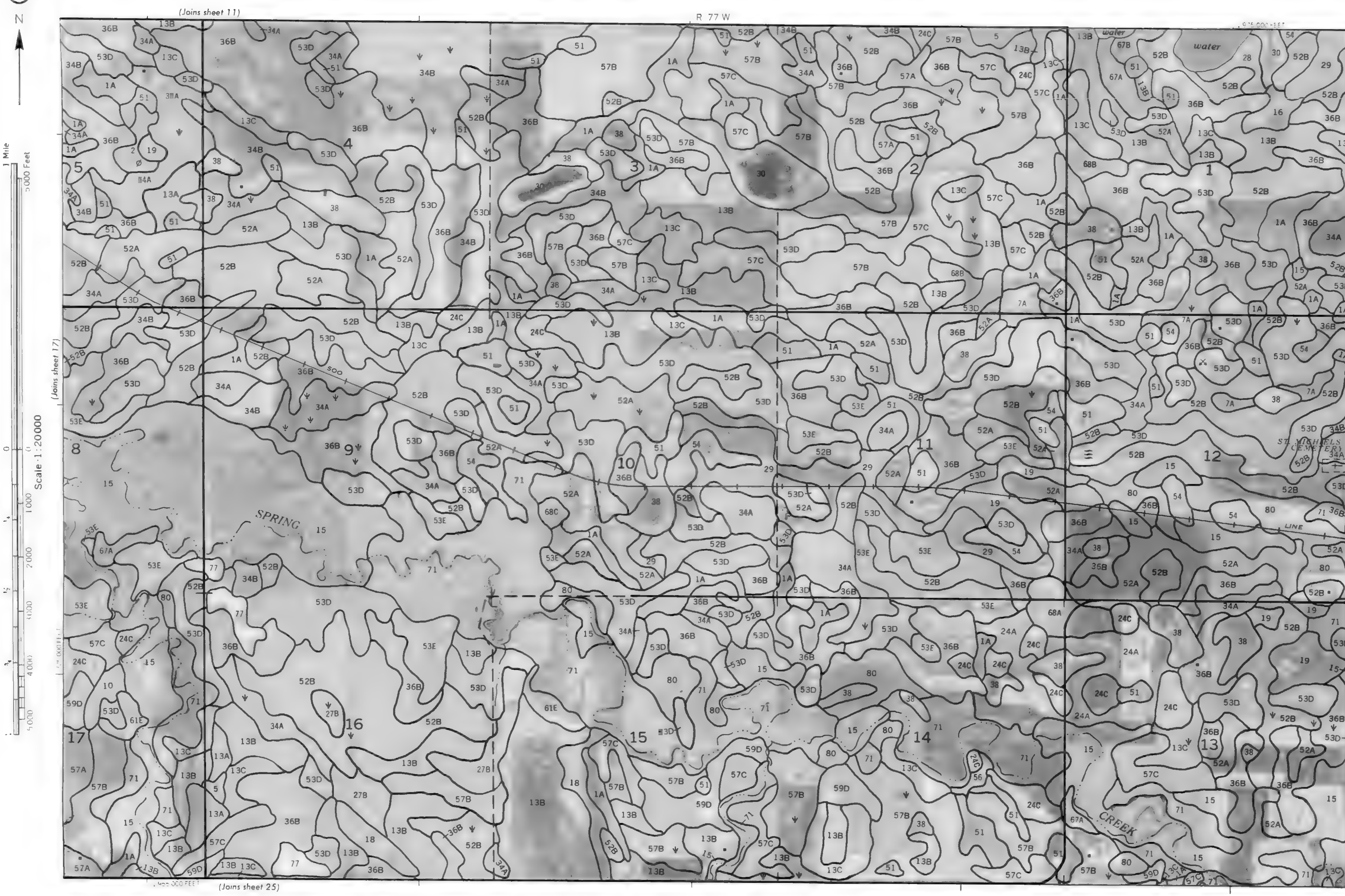
(Joins sheet 23)

1 Mile 5000 Feet

Scale 1:20000

0 1000 2000 3000 4000 5000


R 78 W
R 77 W
(Joins sheet 10)
(Joins sheet 16)
(Joins sheet 18)
(Joins sheet 24)
T 127 N
N
SPRING
CREEK
LINE
1 Mile
5000 Feet
Scale 1:20000


18
N
(Joins sheet 11)
R. 77 W.
(Joins sheet 17)
(Joins sheet 19)
(Joins sheet 25)
T. 127 N.
1 Mile
5000 Feet
Scale 1:20000
water
SPRING
CREEK
ST. MICHAELS CEMETERY
LINE


19
(Joins sheet 12)
R. 76 W.
T. 127 N.
(Joins sheet 18)
(Joins sheet 20)
(Joins sheet 26)
HERREID AIRPORT
FAIRVIEW CEMETERY
Herreid
SPRING CREEK
LINE
83
N
1 Mile
5000 Feet
Scale 1:20000

20

N

(Joins sheet 13)

R 76 W | R 75 W

T. 127 N

(Joins sheet 19)

(Joins sheet 21)

(Joins sheet 27)

SPRING CREEK

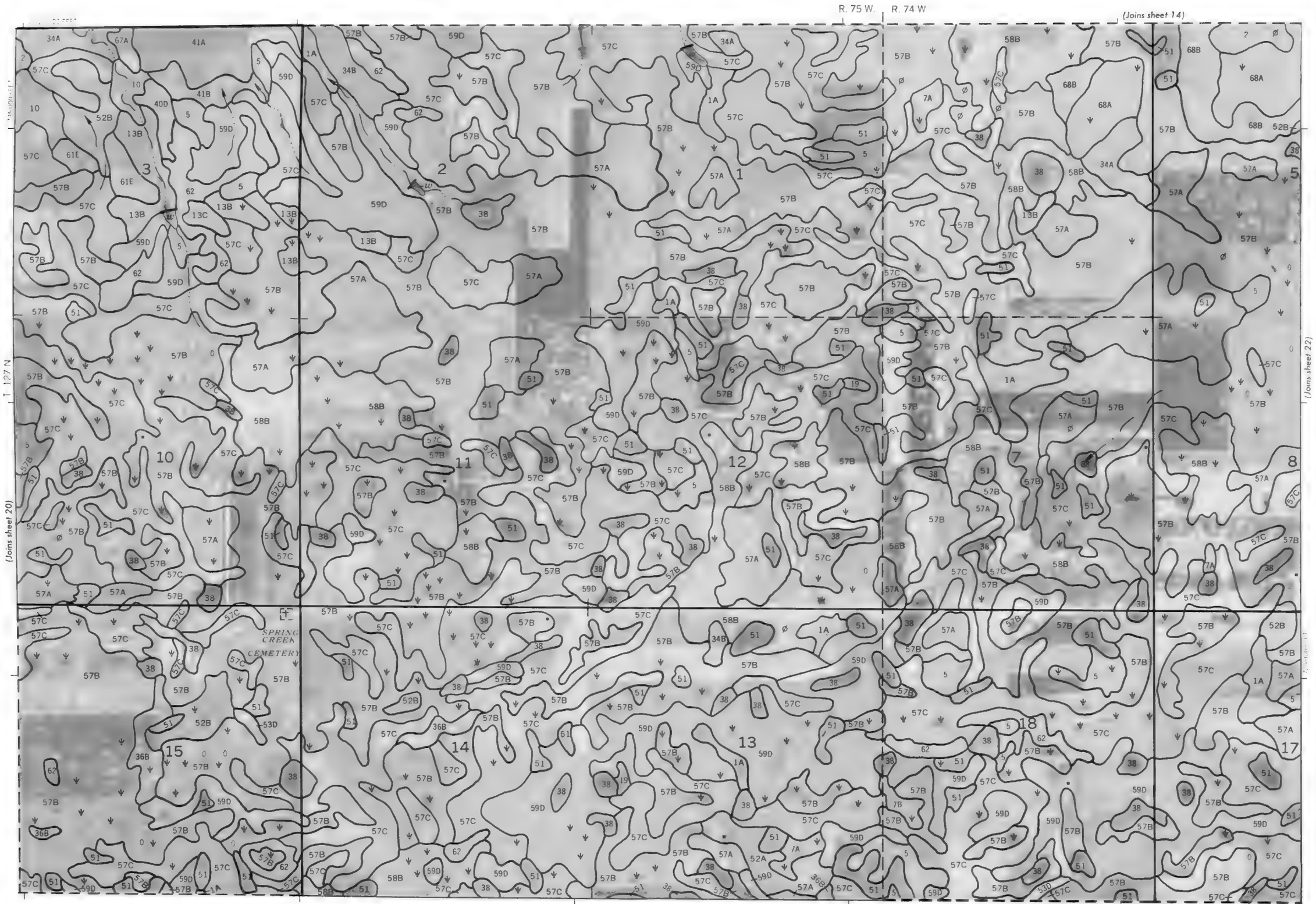
TILGERHEIM CEMETERY

GNADENFELD CEMETERY

1 Mile 5000 Feet

Scale · 1:20000

CAMPBELL COUNTY, SOUTH DAKOTA — SHEET NUMBER 21



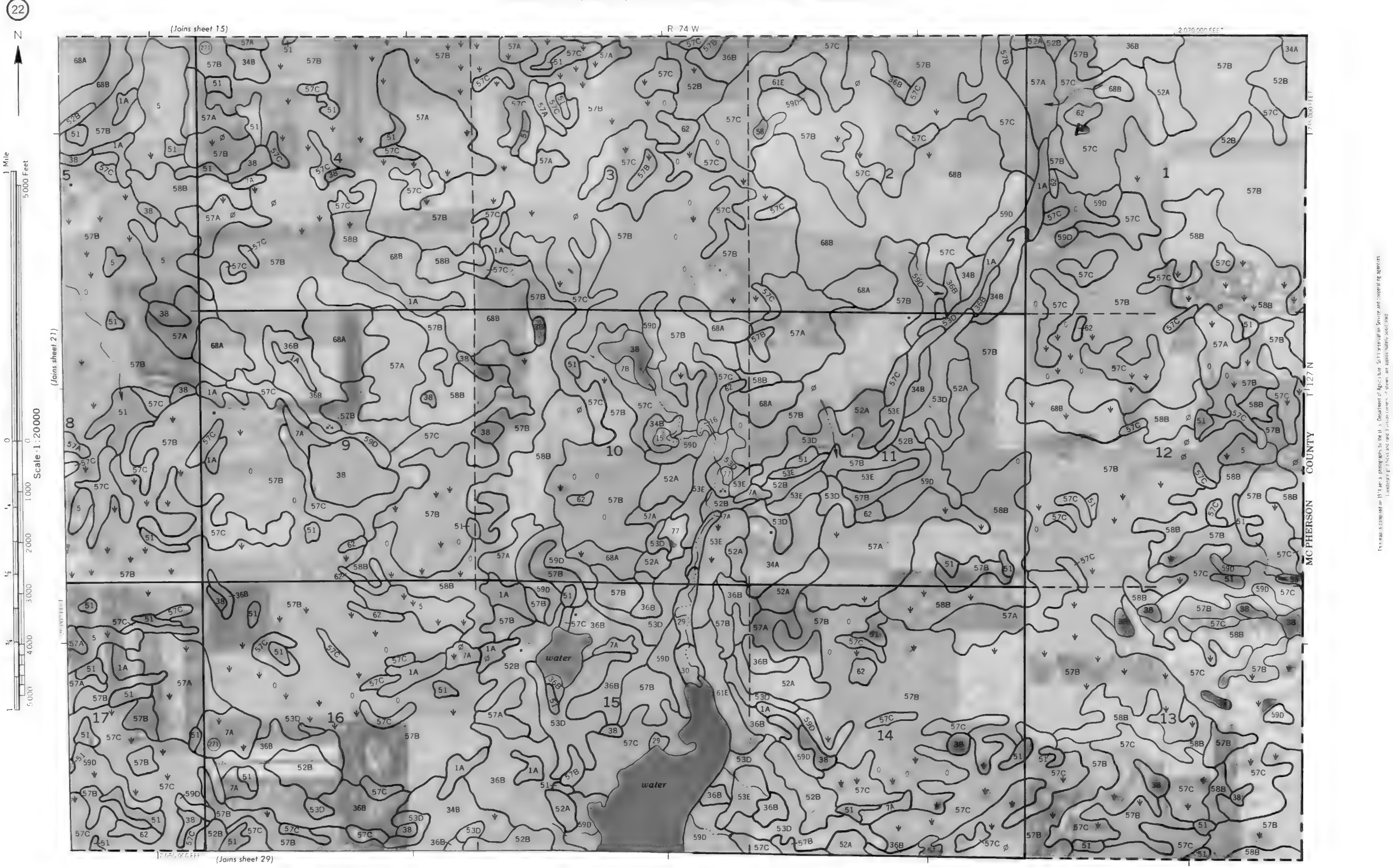
21

N

1 Mile

5000 Feet

Scale 1:20000


22
N
(Joins sheet 15)
R 74 W
(Joins sheet 21)
(Joins sheet 29)
T 127 N
MC PHERSON COUNTY
1 Mile
5000 Feet
Scale 1:20000
water
water

CAMPBELL COUNTY, SOUTH DAKOTA — SHEET NUMBER 23

23

N

R. 79 W. | R. 78 W.

(Joins sheet 16)

(Joins sheet 24)

(Joins sheet 30)

T. 127 N.

COHSON COUNTY

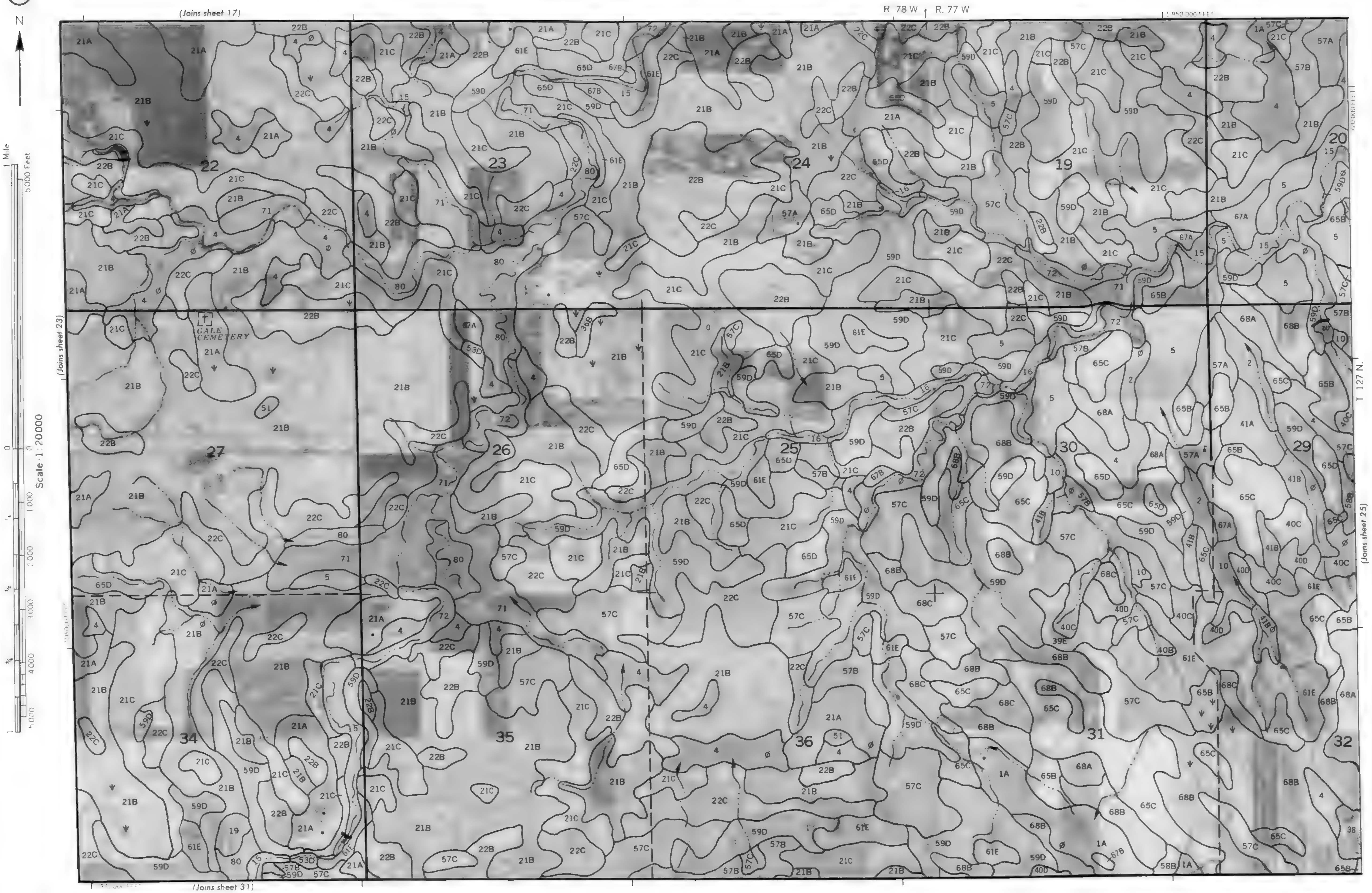
LAKE OAHE

INDEFINITE BOUNDARY

1 Mile

5000 Feet

Scale 1:20000


N
(Joins sheet 17)
R 78 W
R. 77 W
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 31)
T 127 N.
GALE CEMETERY
1 Mile
5000 Feet
Scale 1:20 000
22
23
24
19
20
27
26
25
30
29
34
35
36
31
32

CAMPBELL COUNTY, SOUTH DAKOTA — SHEET NUMBER 25

25

N

R 77 W

T 127 N

(Joins sheet 18)

(Joins sheet 24)

(Joins sheet 26)

(Joins sheet 32)

SPRING CREEK

1 Mile

5000 Feet

Scale 1:20000

CAMPBELL COUNTY, SOUTH DAKOTA — SHEET NUMBER 26

(26)

N

R 76 W

(Joins sheet 19)

(Joins sheet 25)

(Joins sheet 27)

(Joins sheet 33)

T. 127 N

SPRING CREEK

McClarem Lake

Scale · 1 : 20000

1 Mile

5000 Feet

CAMPBELL COUNTY, SOUTH DAKOTA — SHEET NUMBER 27

27

N

R 76 W | R 75 W

(Joins sheet 20)

T 127 N

(Joins sheet 26)

(Joins sheet 28)

2 020 000 FEET

(Joins sheet 34)

1 Mile

Scale 1:20000

28

N

R 75 W R 74 W

T. 127 N

(Joins sheet 21)

(Joins sheet 27)

(Joins sheet 29)

(Joins sheet 35)

1 Mile 5000 Feet

Scale 1:20000

0 0

1/4 1000

1/2 2000

3/4 4000

1 5000

22 23 24 19 20

27 26 25 30 29

34 35 36 31 32

10

R. 74 W

(Joins sheet 22)

T. 127 N

(Joins sheet 28)

(Joins sheet 36)

water

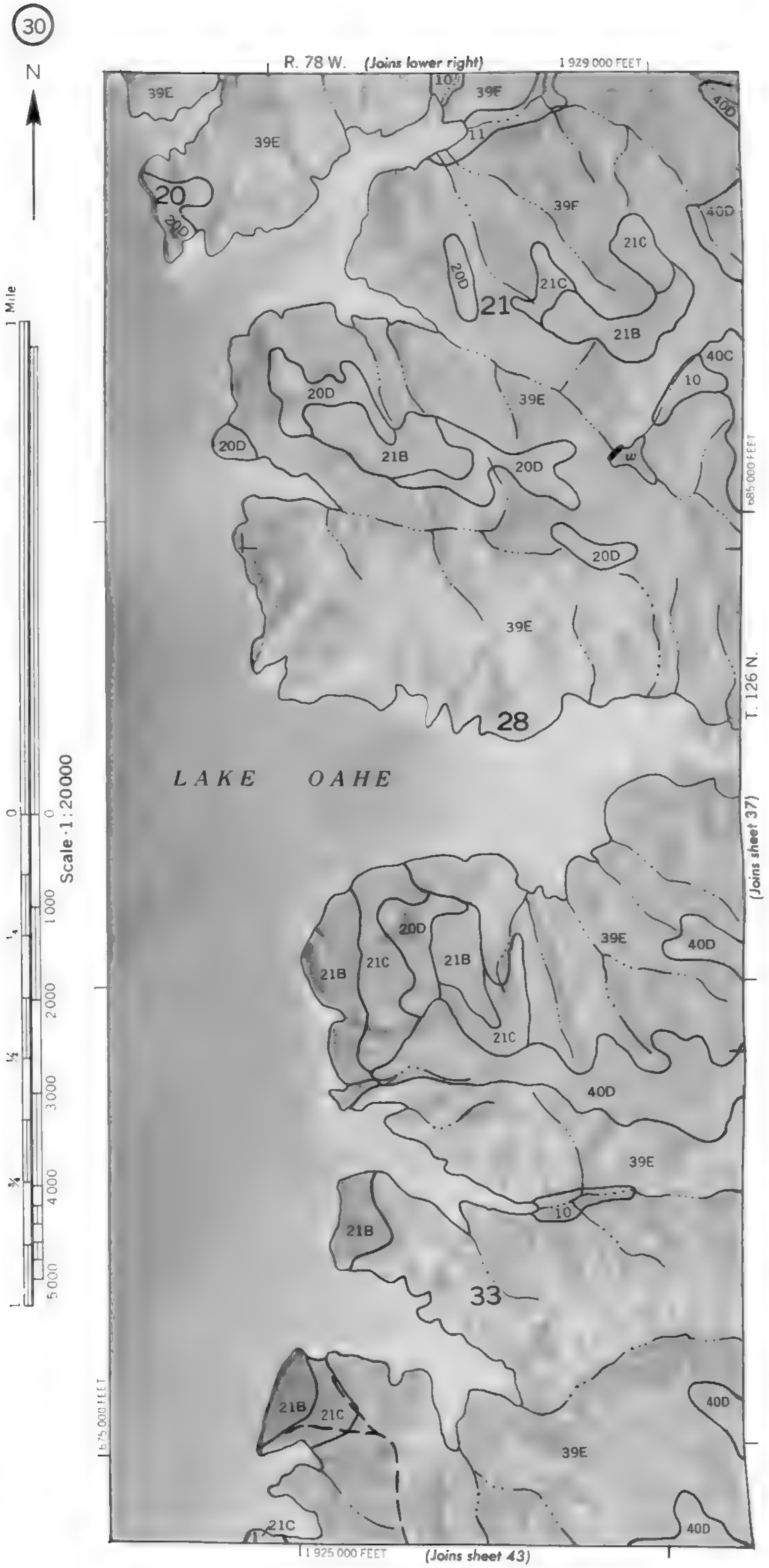
HOFFNUNGSFELDT CEMETERY

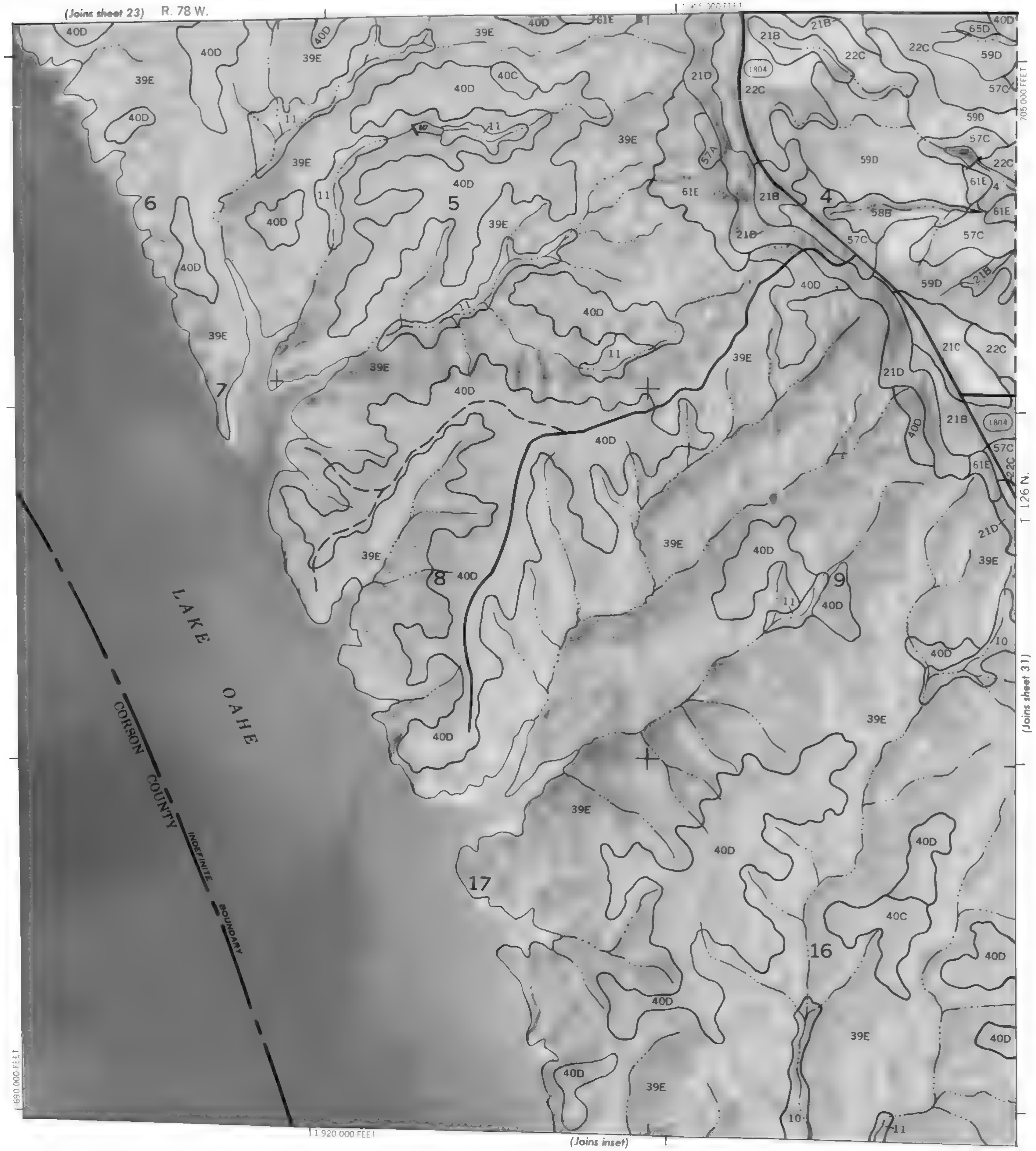
MC PHERSON COUNTY

Scale 1:20000

1 Mile

5000 Feet





aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
grid ticks and land division corners, if shown, are approximately positioned

R 78 W | R 77 W

(Joins sheet 24)

T 126 N

(Joins sheet 30)

(Joins sheet 32)

(Joins sheet 37)

KIERNES CEMETERY

N

1 Mile

5000 Feet

Scale 1:20000

(32)

(Joins sheet 25)

R 77 W

(Joins sheet 31)

(Joins sheet 33)

(Joins sheet 38)

T 126 N

N

1 Mile

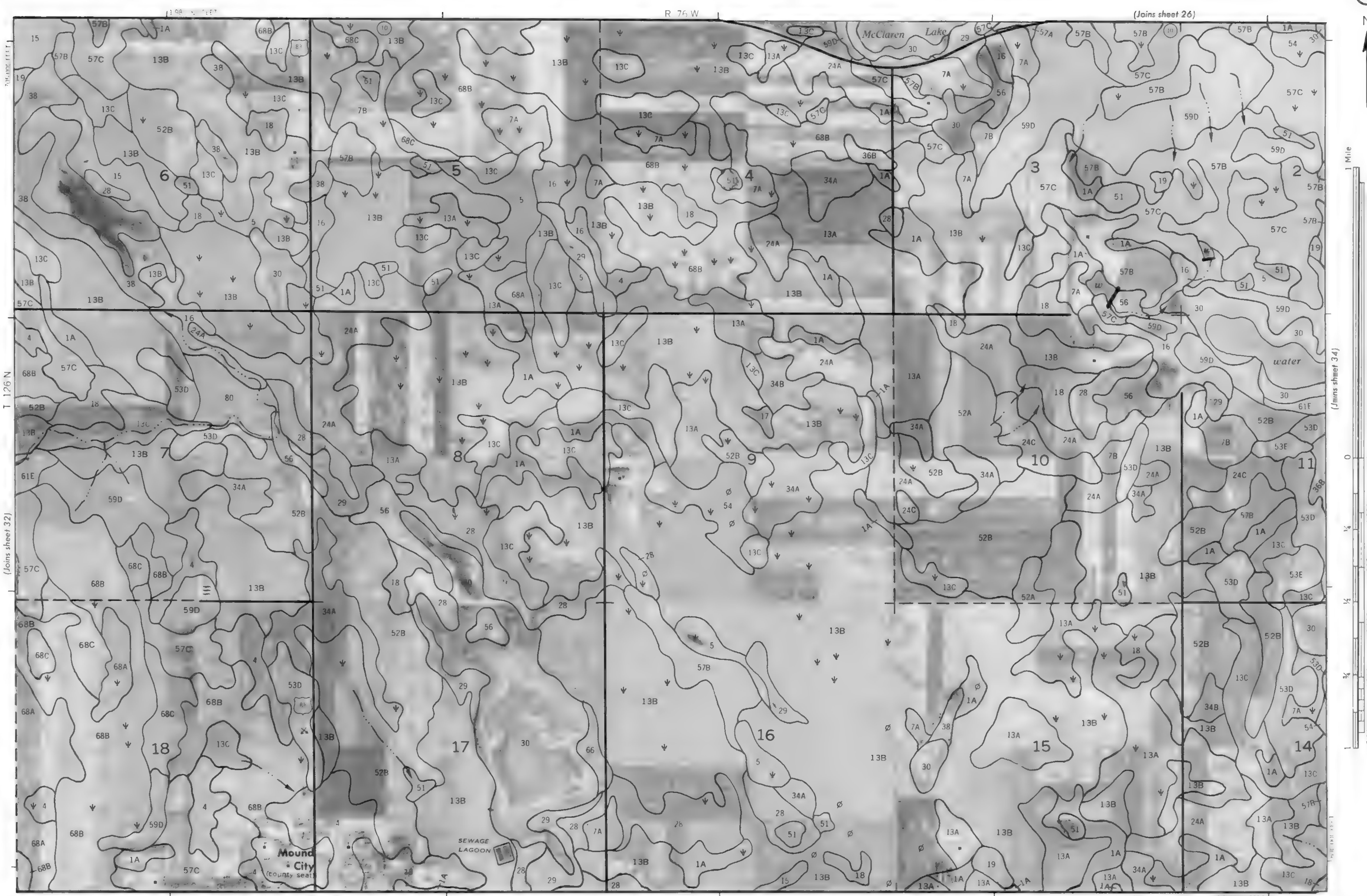
5,000 Feet

Scale 1:20000

Lake Campbell

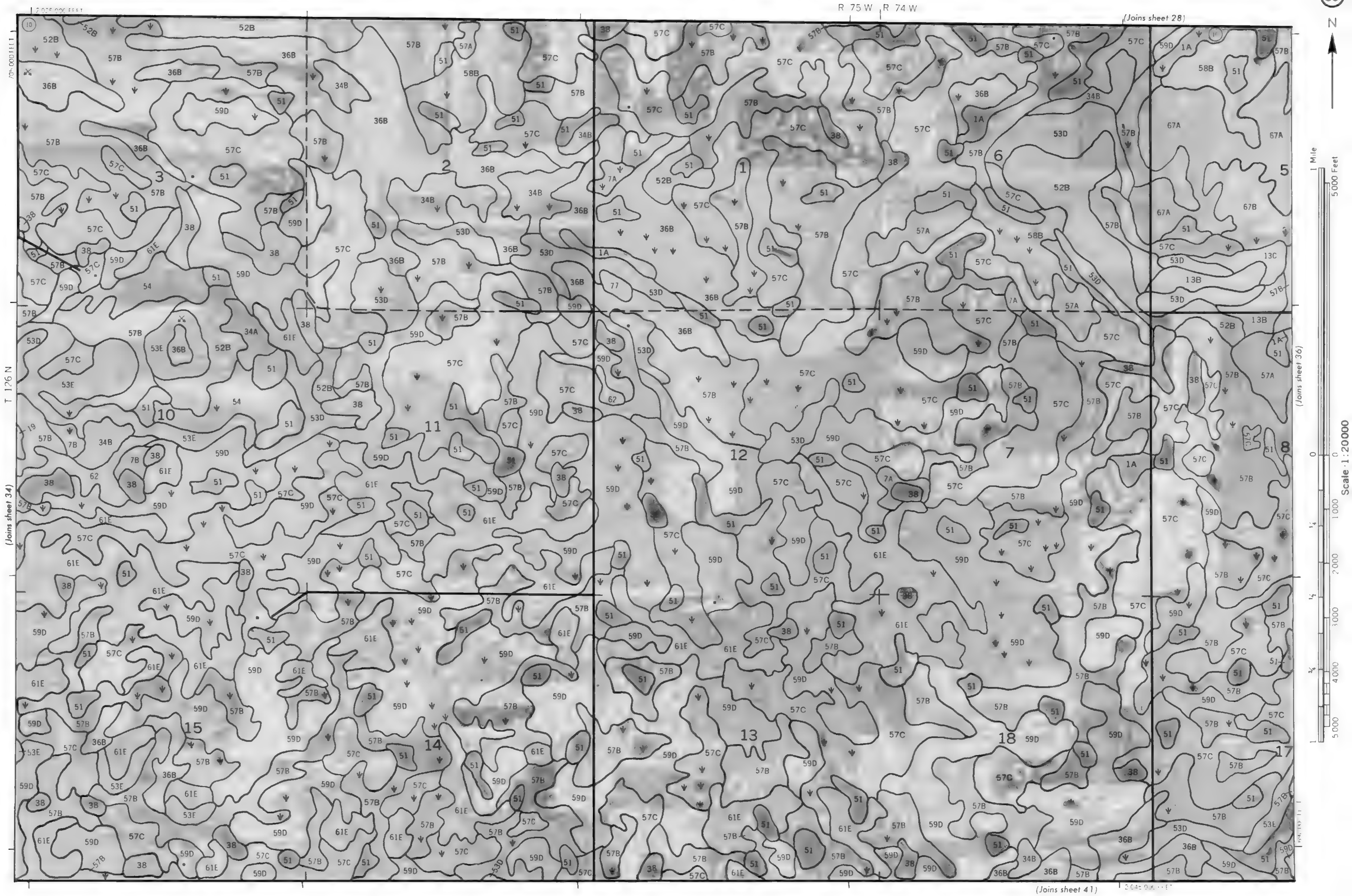
Olson

61E Creek



R. 76 W.
T. 126 N.
(Joins sheet 26)
(Joins sheet 34)
(Joins sheet 39)
(Joins sheet 32)
McClaren Lake
water
SEWAGE LAGOON
Mound City
(county seat)
N
1 Mile
Scale 1:20000

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


R 75 W
R 74 W
(Joins sheet 28)
(Joins sheet 34)
(Joins sheet 36)
(Joins sheet 41)
T 126 N
N
1 Mile
5000 Feet
Scale 1:20000

N

(Joins sheet 29)

R 74 W

2 070 000 FEET

(Joins sheet 35)

(Joins sheet 42)

1 Mile

5000 Feet

Scale 1:20000

MC PHERSON COUNTY T. 126 N.

CAMPBELL COUNTY, SOUTH DAKOTA — SHEET NUMBER 37

37

N

1 Mile

5000 Feet

Scale 1:20000

38

N

(Joins sheet 32)

R. 77 W.

1 Mile

5000 Feet

Scale 1:20000

(Joins sheet 37)

(Joins sheet 39)

(Joins sheet 45)

T. 126 N.


R 76 W
(Joins sheet 33)
(Joins sheet 38)
(Joins sheet 40)
(Joins sheet 46)
T 126 N.
MOUND CITY CEMETERY
Renz Lake
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35
N
1 Mile
5000 Feet
Scale 1:20000

(40)

N

Scale 1:20000

1 Mile 5,000 Feet

0 1000 2000 3000 4000 5000

R 76 W | R 75 W

T. 126 N

(Joins sheet 34)

(Joins sheet 39)

(Joins sheet 41)

(Joins sheet 47)

water

R. 75 W. R. 74 W

(Joins sheet 35)

T. 126 N.

(Joins sheet 40)

(Joins sheet 42)

(Joins sheet 48)

N

1 Mile

5000 Feet

Scale 1:20000

0 ½ 0 1000 2000 3000 4000 5000

water

(42)

N

1 Mile

5,000 Feet

Scale · 1:20000

(Joins sheet 36)

R. 74 W.

20,000 FEET

COUNTY T. 126 N.

McPHERSON

(Joins sheet 41)

(Joins sheet 49)

water

water

water

N

1 910 000 FEET

R. 79 W. | R. 78 W.

(Joins inset, sheet 30)

670 000 FEET

T. 125 N.

CORSON COUNTY INDEFINITE BOUNDARY

LAKE OAHE

(Joins sheet 43)

(Joins sheet 44)

(Joins inset, sheet 43)

(Joins sheet 50)

(Joins sheet 51)

1 925 000 FEET

3000 AND 5000-FOOT GRID TICKS

1 Mile

5000 Feet

Scale 1:20000

44

N

(Joins sheet 37)

R. 78 W. | R. 77 W.

1 950 000 FEET

670 000 FEET

T. 125 N.

(Joins sheet 43)

(Joins sheet 45)

660 000 FEET

1 930 000 FEET

(Joins sheet 52)

1 Mile 5000 Feet

Scale 1:20000

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Coordinate grid ticks and divisions are approximately positioned

N

R 77 W

(Joins sheet 38)

(Joins sheet 46)

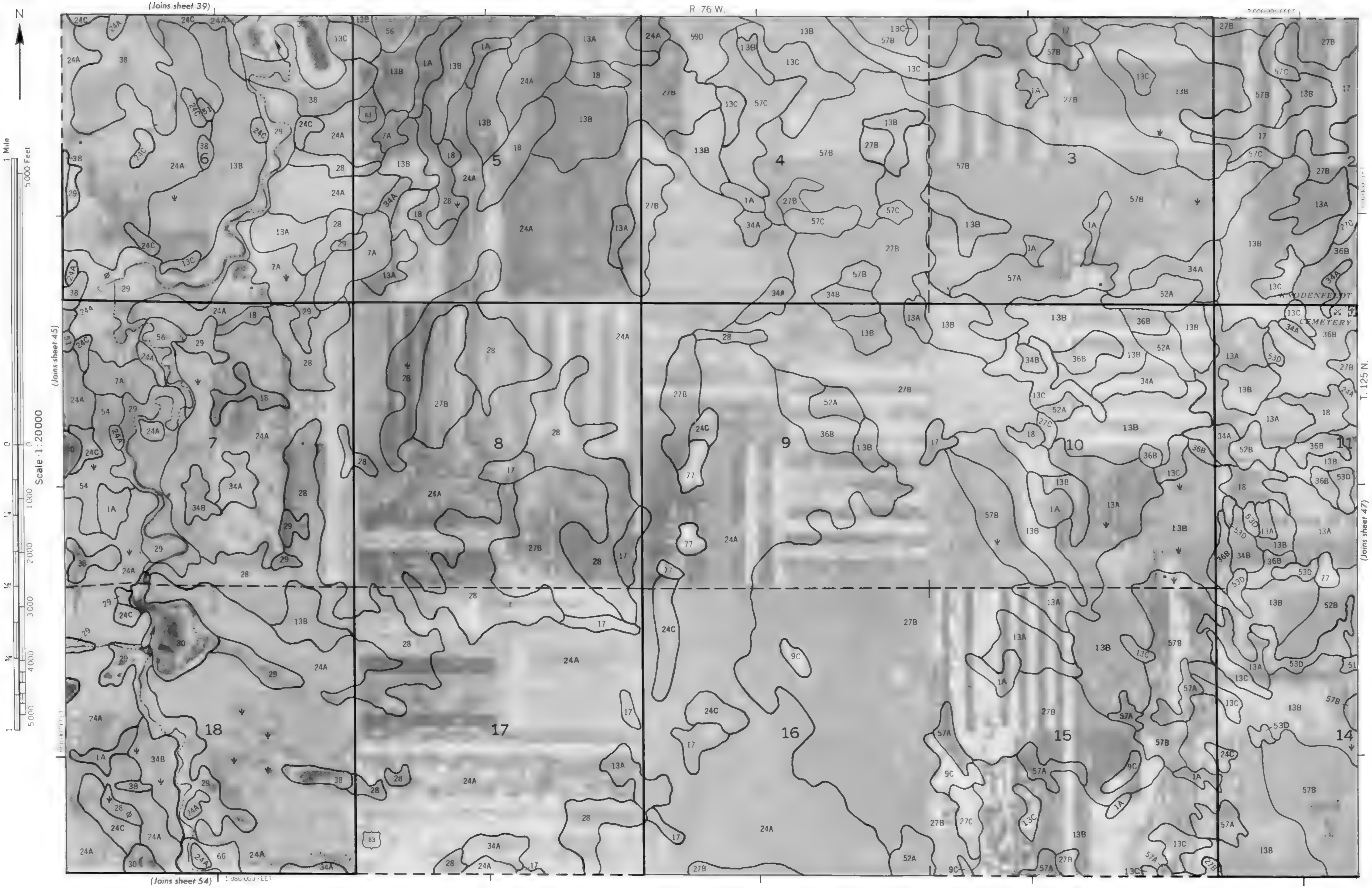
(Joins sheet 44)

(Joins sheet 53)

1 Mile

5000 Feet

Scale 1:20000


N
(Joins sheet 39)
R. 76 W.
(Joins sheet 45)
(Joins sheet 47)
(Joins sheet 54)
T. 125 N.
Scale 1:20000
1 Mile
5000 Feet
CEMETERY


2 005 000 FEET
R. 76 W.
R. 75 W.
(Joins sheet 40)
T 125 N.
(Joins sheet 46)
(Joins sheet 48)
(Joins sheet 55)
2 020 000 FEET
Salt Lake
N
1 Mile
5000 Feet
Scale 1:20000

(48)

N

(Joins sheet 41)

R. 75 W.

R. 74 W.

2 045 000 FEET

T. 125 N

(Joins sheet 47)

(Joins sheet 49)

FRIEDENSTALL CEMETERY

Salt Lake

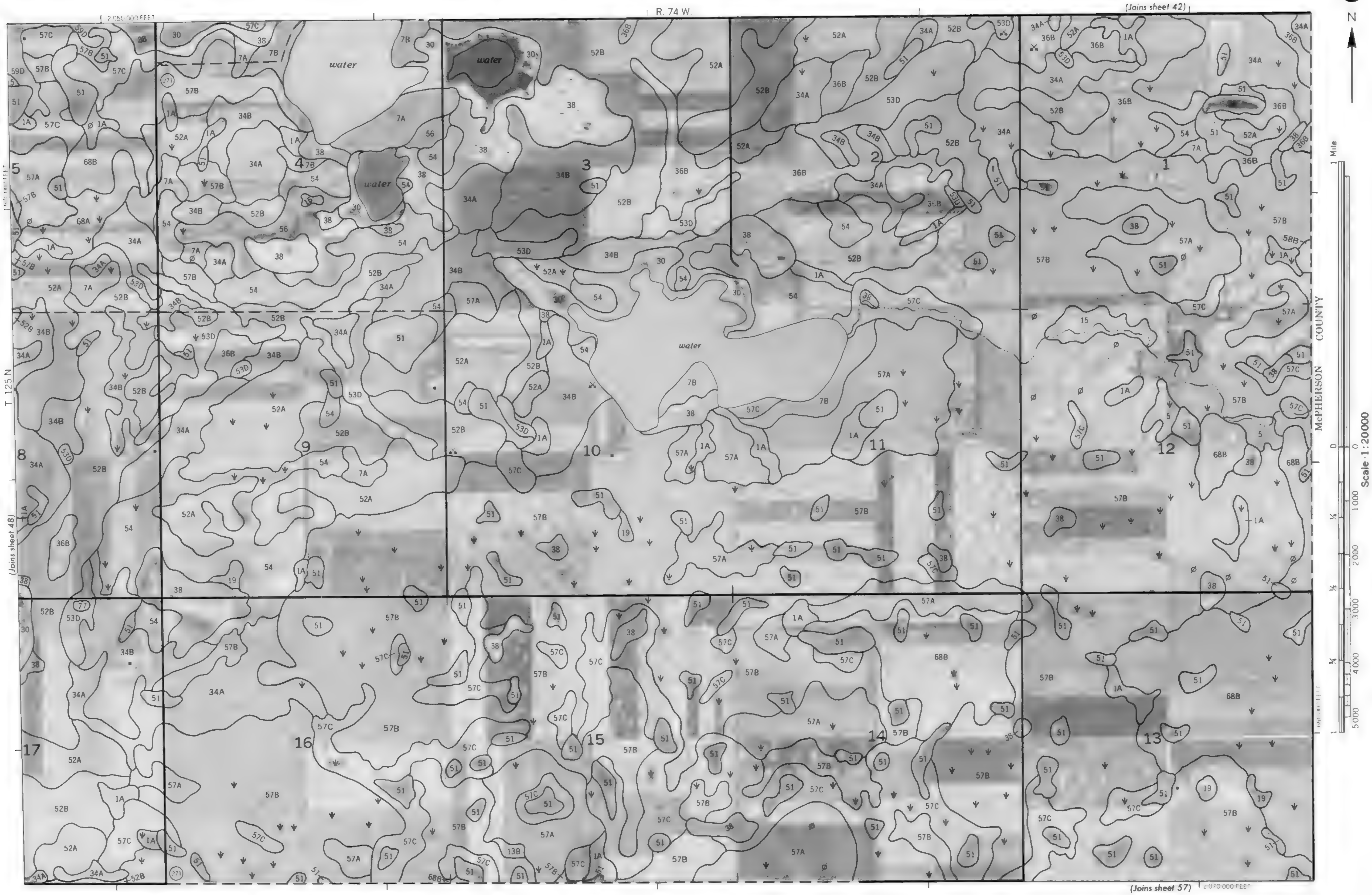
2 025 000 FEET

(Joins sheet 56)

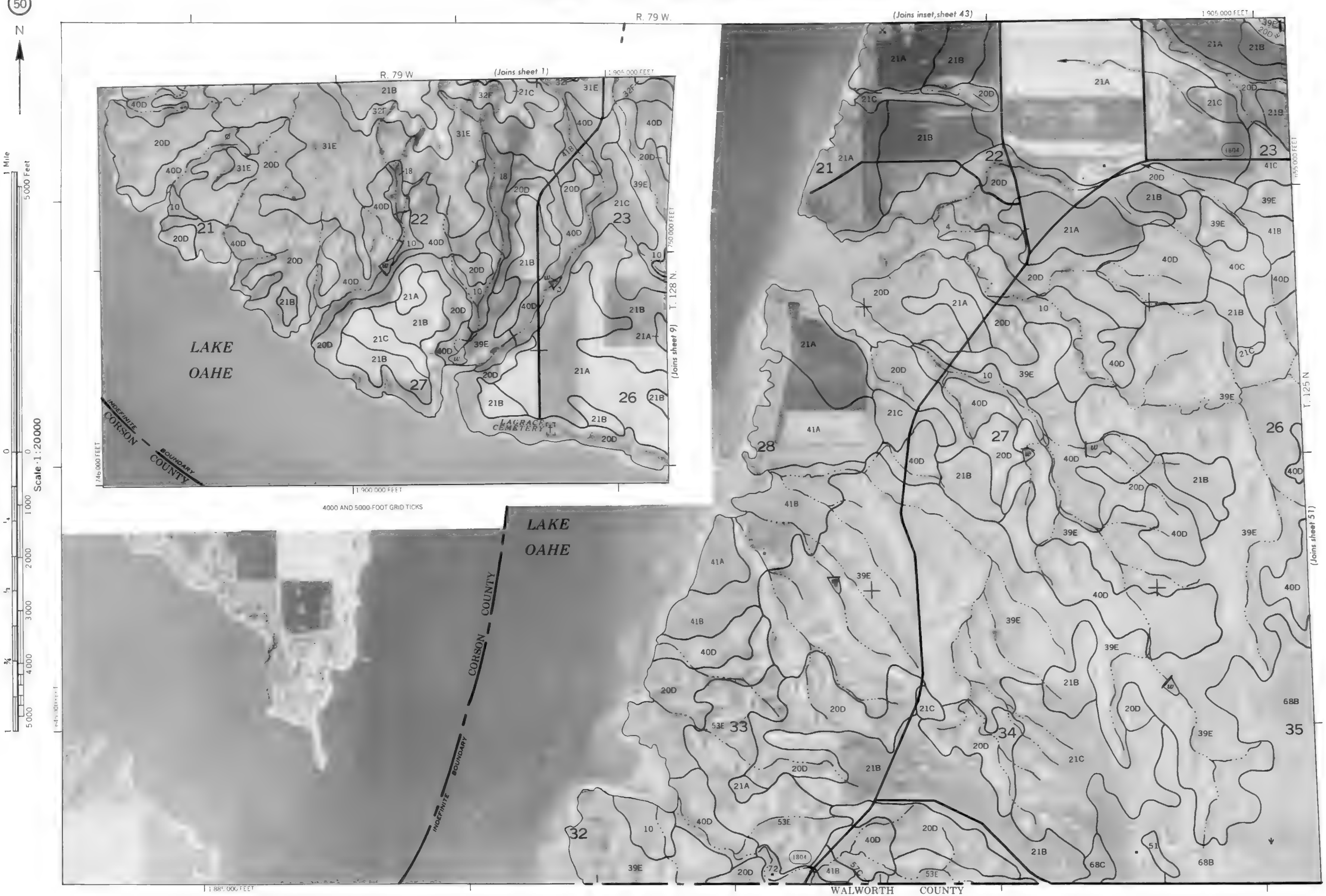
1 Mile

5000 Feet

Scale 1:20000



This map is compiled on [illegible] aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


50
N
1 Mile
5000 Feet
Scale 1:20000
R. 79 W.
(Joins inset, sheet 43)
(Joins sheet 1)
(Joins sheet 9)
(Joins sheet 51)
T. 128 N.
T. 125 N.
LAKE OAHE
LAKE OAHE
CORSON COUNTY
INDEFINITE BOUNDARY
WALWORTH COUNTY
LAGRACE CEMETERY
4000 AND 5000-FOOT GRID TICKS
1 905 000 FEET
1 900 000 FEET
1 885 000 FEET
750 000 FEET
21
22
23
26
27
28
32
33
34
35

CAMPBELL COUNTY, SOUTH DAKOTA — SHEET NUMBER 51

51

N

R. 79 W. | R. 78 W.

(Joins sheet 43)

(Joins sheet 52)

(Joins sheet 50)

T 125 N

WALWORTH COUNTY

1 Mile

5000 Feet

Scale 1:20000

N

Scale 1:20000

1 Mile 5,000 Feet

R. 78 W. R. 77 W.

1,950,000 FEET

1,930,000 FEET

T 125 N

(Joins sheet 44)

(Joins sheet 51)

(Joins sheet 53)

ST PETER'S CEMETERY

Creek

Cane

WALWORTH COUNTY

CAMPBELL COUNTY SOUTH DAKOTA — SHEET NUMBER 53

53

N

R. 77 W.

(Joins sheet 45)

T. 125 N.

(Joins sheet 52)

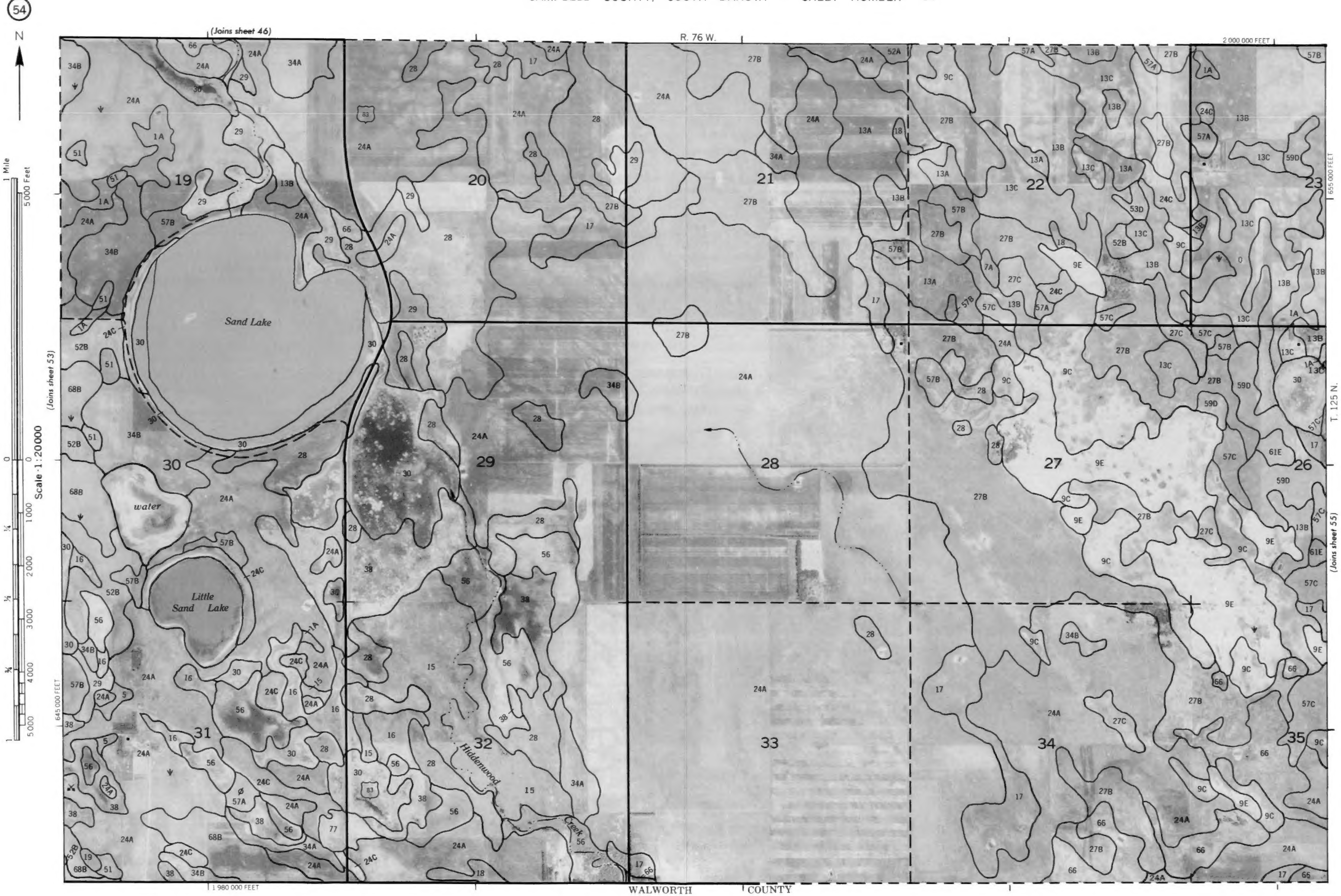
(Joins sheet 54)

WALWORTH COUNTY

1 Mile

5000 Feet

Scale 1:20000



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2 005 000 FEET

R. 76 W. | R. 75 W.

(Joins sheet 47)

655 000 FEET

T 125 N

(Joins sheet 54)

(Joins sheet 56)

645 000 FEET

2 020 000 FEET

WALWORTH COUNTY

Lake Salt

55

N

1 Mile

5 000 Feet

Scale 1:20000

(56)

N

(Joins sheet 48)

R. 75 W. | R. 74 W.

2 045 000 FEET

655 000 FEET

T. 125 N.

(Joins sheet 55)

(Joins sheet 57)

645 000 FEET

2 025 000 FEET

Salt Lake

1 Mile
5 000 Feet
Scale 1:20000

WALWORTH COUNTY

2 050 000 FEET

R. 74 W.

(Joins sheet 49)

655 000 FEET

T. 125 N.

(Joins sheet 56)

WALWORTH COUNTY

McPHERSON COUNTY

2 070 000 FEET

645 000 FEET

57

N

1 Mile

5 000 Feet

Scale 1:20000